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Original Articles.

A NEW METHOD FOR THE RADICAL CURE OF HERNIA BY THE GALVANO-CAUTERY.

BY JOHN C. MINOR, M.D.

(Read before the Medico-Chirurgical Society, New York, January, 1879.)

"Quod remedium non sanat, ferrum sanat: quod ferrum non sanat, ignis sanat; quod ignis non sanat, insanibile dici debet."—HIPPOCRATES. (Aphor.)

THE suggestion now offered with reference to the radical cure of hernia involves no new points in the pathology of the disease, nor is it in any sense a departure from the principles already established concerning the cure of hernia. It is new merely in the method of producing the pathological process of adhesive inflammation necessary for a cure. Never having tried it I can say nothing about its merits as compared with other methods from any experience of its use, but a familiarity with the ordinary operations for the radical cure of hernia, and particularly that devised by Mr. Woods, of London, and known by his name, has perhaps qualified me to appreciate some of the defects in the ordinary methods of cure. Pending a trial of its action, a brief consideration of the *modus operandi* of the

method I now suggest may show a reasonable ground for expecting good results from it.

The different operations for the radical cure of hernia all have for their object the obliteration of the sac, either immediately by the adhesion of its walls, or mediately through the interposition of a plug formed from the adjacent tissues and the contraction of the tendinous opening. It has been objected to these methods that their action is only on the sac, while more than this is required. "When the ring has been dilated by the descent of the viscera," observes Lawrence, "we cannot reasonably expect that the mere closing of the sac will form a sufficient obstacle to a fresh protrusion; we want a remedy that should contract the tendinous opening, for while that remains preternaturally large a new protrusion is a highly probable occurrence." There is great force in this objection, and it certainly holds good against the old seton operation and the treatment by irritating injections. The methods of Gerdy, Wutzel, and others, which plug the original canal by an invaginated portion of the scrotal tissue, are open to another objection, namely, they dilate a canal already too large, and on the posterior surface of the plug there is no adhesion between the contiguous surfaces; thus a passage is left open for the reproduction of the hernia.

To insure a more successful result, the more modern methods of Wood and others have aimed at a contraction of the inguinal ring, so that there shall be no escape of the intestine from the abdominal cavity, and, in addition to this, the original canal is closed either immediately by adhesive inflammation of its walls, or mediately by an invaginated portion of the scrotum, so that the contraction of the tendinous opening is reinforced by a contraction of the canal, both together forming a very efficient obstacle to the descent of the hernia. The theory of Wood's operation commends itself at once as reasonable and judicious. Its success is also undoubted, notwithstanding the objections of those to whom everything new is objectionable. And yet it is by no means a rare thing for a rupture that has been apparently radically cured to reappear after several weeks

or months, and generally work its way down to its former place and acquire its former dimensions. There is then a weak point in the operation, and this appears to me to lie in the character of the adhesions as ordinarily produced. The adhesion produced by setons or irritating injections under the effect of weight or pressure may become absorbed, may stretch or even give way entirely, especially in the earlier periods of their existence. Thus the radical cure of hernia often fails, not from any fault in the operation itself, but because the adhesions are not firm enough to sustain the pressure from above or the weight from below. If every patient could be kept on his back long enough, no doubt every case could be cured; but the application of a truss and permission to go about on his feet brings pressure from above by the hernia, pressure from the outside by the truss, and the weight of the scrotum from below, all operating to absorb, stretch, or tear apart the newly-formed adhesions.

The method I suggest is to form the adhesion by the galvano-cautery without invaginating any scrotal tissue, depending upon the natural or pathological tendency of all cicatrices produced by burns to contract and grow stronger and thicker by age. As compared with other adhesions they are firmer, less liable to absorption, and present to a remarkable degree the very conditions that are so essential for the radical cure of hernia. I would not trust to these alone in the beginning, but would urge the necessity of closing the tendinous opening by wire sutures, so as to keep the protrusion if possible within the abdominal cavity. But if in addition to this closure of the tendinous opening we seal up the canal by firm cicatrices, it seems to me that the result must be far more certain than after the usual operation. The operation in brief, is as follows:

The hernia having been reduced, the internal ring is closed by silver sutures after Dowell's method. An incision is then made in the most depending portion of the inguinal canal, the cord and vessels clearly made out and covered with an ivory guard, that is passed in front of them and up the inguinal canal until it impinges upon the contracted ring above. The dome

cautery, while cold, is next passed up the canal in front of the ivory guard, which separates it from the cord and vessels, until it meets with the obstruction at the contracted tendinous opening. First withdrawing the cautery a few lines, the spring is pressed, the cautery becomes red hot and is slowly withdrawn, thoroughly cauterizing the tissues in front of the cord, which is protected from impinging by the interposition of the ivory guard. In those cases where the weight of the hernia has drawn the external and internal rings until the orifices are nearly in apposition, the entrance and exit of the cautery should be at a point in the scrotum midway between the external ring and the most depending portion of the scrotum.

The silver wires should be left *in situ* for at least ten days, or until some necessity arises for their removal. In all other respects the treatment is to be conducted on general principles. The advantage of this method consists entirely in the difference between the contracting scar of a burn and the ordinary results of adhesive inflammation produced in other ways. The cicatrix once formed grows firmer with age, cannot be absorbed, neither stretches nor tears, but holds the tissues in a grip that never relaxes. So far as the immediate inflammatory action is concerned, following the operation, it might be more intense than that produced in other ways, but it is less likely to spread beyond the parts operated on, and offers the minimum amount of danger from septicæmia. There appears to me to be but one objection to the method, and that applies to the effect of contracting cicatricial bands upon the nutrition of the cord and its vessels. It is probable that if it acted at all to impair the nutrition of the parts, the slowness of action would lead to a gradual atrophy of the testicle. But I doubt whether any such result would occur. In the absence of practical experience it is impossible to determine whether this objection is of actual weight or of merely theoretical importance, and so without further discussion I leave the subject *sub judice*.

ARTICLE II.

SHOCK.

BY WALTER Y. COWL, M.D.

NERVOUS shock is a frequent cause of unexpected death. It therefore continues to be a subject of intense interest to all those who have to do with its prevention or treatment. This number we may say includes every practitioner; for injuries, frights, perforations of cavities in disease, etc., accompanied by more or less shock, are occurrences happening in every one's practice.

Upon reviewing the literature of the subject one readily perceives the absence of laborers engaged in the special study of nervous affections and the relegation of shock entirely to the surgeons, who naturally make no pretence to the study of nervous phenomena, pathological or physiological. From these facts it results that shock has been treated almost entirely from its clinical standpoint. But little therefore is positively known of the pathology of shock.

That deaths from shock are continually occurring, which, with our present knowledge, we are unable to foresee or to prevent, the experience of the greatest surgeons tell us.* The question presents itself: How can we help it? The only way to prevent a condition is first to understand it. By studying the operation of shock upon the system, by ascertaining its causes, both predisposing and exciting, will we be able to take measures that will prevent this direful accident wherever possible.

That surgery has not traced the nervous phenomena of shock to their causes is due, we believe, to her slight employ-

* "How often have we not had the pain of seeing in our great hospital services those rapid deaths which nothing could anticipate nor give us cause to apprehend, which alike surprise the most attentive surgeon and astonish those most accustomed to sudden death."—Des Causes de la Mort Prompte apres les grandes Traumatismes Accidentels et Chirurgicaux. F. Eugéne Vincent, 1878. Libraire de l'academie de médecine. Paris.

ment of physiological experimentation, the touchstone of nervous affections.

Another thing that has prevented the proper study of shock, is the difficulty of obtaining full and accurate histories of cases, at least where death has occurred; in the first place surgeons, except perhaps the most noted, dislike it to become known that they have had a death from shock; they do not readily relate their cases. That there should be no reason for this in fact is very apparent when we read the records of numerous operations where the occurrence of shock seemed barely possible, yet where it gave the death-stroke, and that under the eye of a master.

To say that we operated and that the patient died of shock, seems to imply that the death is somewhat due to our fault. The term shock has an ominous sound. This at least is the way the American surgeon looks at it. The fact is evidenced every now and then by some death certificate returned because of a very apparent evasion* of the term,† and again by any statistics‡ of operations where the immediate cause of death of those who died is given—the rarity of shock and the frequency of asthenia or exhaustion§ within the first three days is at least interesting. It would be better for medical science

* As a late substitution by an eminent surgeon of death from ether for death from shock in a patient who died three days after an operation for deformity, recalls to mind.

† A frequent occurrence with the Registrar of Vital Statistics.—Oral Com., 1879.

‡ See Report of Health Department, New York city, for 1874 and 1875. Report of Registrar of Vital Statistics, pp. 537 to 540. Of the two hundred and seventy-seven deaths from operations in the two years, five only were returned as due to shock. See also Erichsen on Hospitalism and the Causes of Death after Operations. London, 1874.

§ Before assigning exhaustion as the cause of a death occurring within a few days after an operation, it is certainly well to ask the question, would not the patient have lived much longer if the operation had not been performed; if so, surely the death is due to the shock of the operation, even if the nutrition of the patient has been lowered, for the shock was its very cause. Again, shock must not be mystified under the term nervous exhaustion.

as well as for ourselves to stop and think in each case whether the death is not really due to shock, and put it on our death certificate; not to deceive ourselves with terms, nor the proximate cause of the shock, for instance, urethral chill, pain, fright, fear, operation under incomplete anæsthesia, etc.

Another cause for the imperfection of the records of shock is the lack of detail in published histories and probably in the original case-books. We will mention two things merely, the most important perhaps. The temperature, whose fall has been shown to be such a sure prognostic of death, is seldom recorded, and the pulse is most often described as irregular or feeble without statement of its frequency; one of the best authorities on shock does not state that the pulse is generally frequent, slow, or indifferently one or the other.

The rhythm as to both frequency and regularity, the force as to both amount and evenness (regularity), and the size of the pulse would seem to be very important facts with which to aid a study of the pathology of shock.

Lastly, the matter of autopsies, of thorough autopsies, has been neglected. We need first to separate those cases where no lesion is discoverable from those in which such is present, and especially from those where, without outward sign, there may be disorganization of portions of the nervous mass,—contusion, hæmorrhage, etc.,—as in cases of concussion.* Again, to notice carefully the condition of the heart, which is so seriously affected in shock.

By availing ourselves of the results of previous physiological experiments upon the nervous system, by making new ones with especial reference to our subject, and by gathering full and accurate records of cases and their autopsies, will we be enabled to clear that pathway which leads to a sound pathology and ends in prevention; while at the same time we shall render ourselves more alert to symptoms upon which to base prescriptions for the relief of those who have unfortunately fallen into this dangerous condition.

* Concussion and Compression, E. C. Franklin, Trans. Am. Inst. 1874.

At present we can say that shock is a reflex depression of the nervous system; that it is a paralysis, more or less severe, more or less general, and more or less different* in one case from what it is in another; while its mode of operation, its pathological process, is still largely an enigma.

Shock varies in severity on the one hand according to the severity of the injury, a shattered limb producing a greater and more persistent shock than a broken bone, while on the other hand it largely depends upon the amount of apprehension of injury. A person fearless of danger, or having received a severe injury is hopeful of recovery, suffers much less from shock than one who is demoralized by fear; this is exemplified by the histories of numerous cases of wounds in battle, where a man with trivial injury will need to be carried from the field, while his neighbor will walk unaided to the hospital after the loss of an arm. Here it is that personal idiosyncrasy tends to prevent the uniform working of our first rule. Again, the severity appears to depend upon the degree of nervous tension present at the time of injury. A sleeping person in a railway car suffers much less from shock than one who is awake, whose nerves are more alert, or who, perhaps, is in apprehension of the impending collision.† Similarly in operations under anæsthesia; deaths from shock are much less frequent than before the advent of ether and chloroform. Again, slight blows upon the abdomen of a man while in muscular action have been known to cause almost immediate death without lesion discoverable *post mortem*.

More or less of the entire nervous system is affected according as the shock is more or less severe, from the extremely sudden death by lightning, etc., where the entire nervous system is at once paralyzed, to depression of the heart's action, etc., without affection of the powers of mind or special sense, or simple acceleration of the heart-beat from small incisions, frights, fear, etc.

Shock varies lastly in regard to the portion of the nervous

* Affecting more particularly one or another part of the nervous system.
† Concussion of the Spine, Erichsen, 1875.

system more particularly affected; for instance, that form where insensibility is present at first, which disappears more or less quickly, and the patient recovers, as in many cases of concussion. Again, after an operation is performed the patient is perfectly conscious, and remains so, although in a condition of severe shock, until near death. A child is scalded and dies within a few hours in coma or convulsions. A man is shaken in a railway collision; after the jar is over he feels no hurt, stirs about, and helps in caring for the wounded and dying; when he has arrived home and the excitement is over, finds that he is not all right, his memory fails, the special senses are anæsthetic, there are local hyperæsthesias, has lost his business aptitude, disposition is changed, etc.*

These variations in shock and its results render the subject all the more difficult of investigation. There are certain classes of causes, however, which, from the elimination of the apprehension of injury, as in unexpected railway collisions, or of pain, as in operations under anæsthesia, afford a profitable field of work.

Morbid Anatomy.—As yet there is no lesion discovered, either minute or gross, which obtains in shock.

Etiology.—The etiology of shock covers, perhaps, a greater number of causes than that of any other fatal affection. Shock in general may be said to be either the result of a sudden injury to the nervous mass, as in wounds, contusions, and extensive compression of the brain or cord, or the result of an intense impression upon the nervous system, as in death from simple concussion (without contusion), lightning, excessive emotion, capital and sometimes other operations, burns, opening and exposure of the great serous cavities, rupture of the heart, and other perforations, or other severe injury.

The most interesting causes, clinically, are surgical operations, as here it is that prevention has a field of action.

Prevention.—The most potent predisposing cause of shock is fear. Anything that lessens this lessens the danger of shock.

* Concussion of the Spine, Erichsen.

Asthenia or exhaustion is recognized as a frequent predisposing cause of shock. Nutrition must needs be carried to its highest point in those thus suffering. The best stimulus to the heart is healthy blood.

Hæmorrhage predisposes to shock; its avoidance as far as possible is necessary.

Ether is less of a depressant than chloroform, and hence is to be preferred where shock is feared.

Especially in sensitive or fearful individuals the beginning of the operation is best deferred till anæsthesia is complete. A touch with the knife is the best test. Death has occurred upon the first stroke of the scalpel in those insufficiently anæsthetized as well as in those not taking an anæsthetic.* The anæsthetic here is but the predisposing cause, shock the exciting cause of death.

The rapid loss of heat from surfaces not accustomed to exposure has been shown to aggravate if not to directly cause shock, hence in abdominal operations the apartment should be warm and moist and the peritoneum as little as possible exposed. In extensive scalds the immediate covering of the surface with a non-conducting material (cotton) has rendered them innocuous.

Symptoms.—The symptoms of shock are a small, feeble, and irregular (in force and rhythm) pulse, which may be either slow or frequent, slow sighing respiration, pale face, pinched features, cold sweat, vertigo, involuntary evacuations, cold extremities, nausea and vomiting, insensibility, convulsions, coma (sometimes) and death, which may follow at least as late as the third or fourth day. The diagnosis is made by the suddenness of the attack, the presence of a primary cause of shock, and a fall of temperature.

Pathology.—We now come to the explanation of these phenomena. As yet it can be but tentative and necessarily brief.

From the frequent sudden death, from the manifest failure of heart-power, as shown by the marked feebleness and irregu-

* Article on Anæsthesia, Holmes's System of Surgery.

larity of the pulse, from the paleness, nausea, vomiting, involuntary evacuations, and cold sweat, together with the retention, more or less, of the powers of thought, speech, sensation, and voluntary motion, we are led to infer that shock kills by paralysis of the heart,* and profoundly affects the sympathetic generally, the impairment of the functions of the cerebro-spinal system being decidedly less severe, and often entirely secondary. There are many cases, however, in which an anæmia of the brain† is evident; among such are those resulting from intense emotion, which from the accompanying syncope seem to be aggravated cases of simple fainting. This cerebral anæmia, however, we believe depends upon a paralyzed sympathetic, and a consequent paralysis (vaso-motor) and distension of the large veins, more especially the afferent trunks of the portal system,† in which stagnation is naturally so liable to occur, and which has been found *post-mortem* to contain the great mass of the blood. Whether cerebral anæmia is present in all cases of shock we are as yet unable to say.

With regard to the action of the medulla oblongata in shock, there is one experiment which leads us to believe that it may be the fatal factor in some cases at least. It is an example of what is called reflex inhibition of the heart by an indirect stimulation of the vagus. If the bared intestines of a frog be smartly struck with the handle of a scalpel, the heart will suddenly stop in diastole; if now, in another frog, both vagi be cut, and the experiment repeated, the heart will not cease nor modify its action. An impulse through the pneumogastric appears to paralyze the heart.

Certain sudden deaths upon receiving a blow upon the abdomen, which need not even be severe,‡ may be due to the paralyzing power of the vagus.

* A true cardiac *paralysis*, a failure of the great sympathetic nerve of the heart, and not a mere muscular *powerlessness* from distension or other cause.

† Ueber den Shok, Sammlung Klinischer Vorträge, H. Fischer. R. Volkman, publisher.

‡ See cases related in Flint's Physiology, also in Des Causes de la Mort Prompte, in which a careful autopsy revealed no lesion.

Shock in general, however, certainly does not have the principal symptom of stimulation of the pneumogastric. Its pulse is irregular and fluttering, rather than increasingly slow, while there are many other symptoms of shock, evidently due to depression of the sympathetic, which this hypothesis does not explain.

The fact that the cardiac contractions do not depend upon the medulla for their continuance, coupled with the absence in shock of embarrassment in respiration and other functions of the pneumogastric, lead us at once to throw out paralysis of the vagus as the fatal factor.

Lastly, in persons who have died from drinking a large quantity of cold water, the heart has been found in a state of tonic contraction, an evident stimulation of the sympathetic (motor) nerve of the heart, possibly by the direct action of the cold.

Prognosis.—The prognosis of shock is to a great degree uncertain: so much must be allowed for individual peculiarities, so little is often known of the actual lesions in any case of injury. It seems to be best indicated by the temperature, a fall of more than 3° F. generally indicating death.

Treatment.—Of treatment little need be said, for the pathway, happily for us, is clear. From their pathogeneses and from the results attained in practice the remedies which appear to be best suited in general to this condition are Camphor, Veratrum, Arsenicum, and Cinchona. They may be administered hypodermically. Of adjuvant measures we have artificial respiration, electricity, frictions, fomentations, dry heat, and, in some cases at least, alcohol in small doses, tentatively used.

Article III.

NERVE-STRETCHING:

Reflex Epilepsy, Spasms, and Neuralgia Cured by Stretching the Ulnar Nerve at the Condyle of the Humerus.

BY WM. TOD HELMUTH, M.D.

On the 25th of March I was called by Dr. Belcher, of New York, to see a gentleman, aged thirty-four years, who had been suffering acutely for several months. The history of the case is as follows: The patient had during childhood enjoyed good health, but when two years of age had been afflicted with convulsions of a violent character, which ceased upon the development of a rash, fine, red and itching, which through a period of six years appeared and disappeared at intervals, without, however, in any way impairing his general health. Some years ago he contracted syphilis, which went through its regular stages and was apparently cured. On the 30th of January, 1879, about 6 o'clock A.M., while going downstairs, he stumbled, and in falling caught the left elbow between the balustrade and the wall, and in the endeavor to wrench it from its position twisted the arm with great violence. The pain that followed was most excruciating, and that night he was seized with a violent epileptiform convulsion, which lasted for a considerable time. The pains in the arm were shooting and darting, extending to the hand and up to the shoulder, and besides depriving him of rest rendered the arm entirely useless. He could scarcely bear the elbow to be touched, could not move the fingers without bringing on a great aggravation of all his sufferings, and the powers of flexion, extension, pronation, and supination were lost. He was irritable and nervous, and his constitution showed evident signs of breaking down. On February 20th another severe convulsion additionally prostrated his system, which was followed by a still more violent one on the 26th of the same month; from that time every two or three weeks he was seized with spasms of greater or lesser severity, which no medicines seemed to control. In fact

he suffered almost daily with *petit mal* (Reynolds), accompanied with periodical and pronounced seizures of *grand mal.*

Besides the traumatism it must be borne in mind that this patient had been afflicted with syphilis, and the constant pain in his head, which was always aggravated *before* the attack, led us to suppose that there were *two* exciting causes rendering the affection intractable.

After consultation I decided to stretch the ulnar nerve just above the point of injury. Accordingly, on the 3d of April, in the presence of Drs. Belcher, Wetmore, Leal, and several medical students the operation was performed. During the process of anæsthesia a violent convulsion took place, which delayed the operation for a few moments. I then flexed the forearm nearly to a right angle with the arm, and exposed the nerve just as it reaches the inner condyle of the humerus to pass into the space between that prominence and the olecranon process. To raise the nerve from its bed in this instance I used a blunt hook, and drew it out about half an inch. I also took care to thoroughly loosen it for about half an inch upwards and downwards. As the patient emerged from his unconsciousness the pains became so severe that $\frac{1}{3}$ grain of Morphia was given. His pulse was 100; temperature, $101\frac{4}{5}°$.

On April 4th, patient passed a fair night. There had been no neuralgia of the arm, but he had suffered severely from pain in the right eye. For this one dose of 5 grains of Quinia bisulph. was prescribed, to be given in the morning. Pulse, 101; temperature, 101°.

April 5th. Slept pretty well, but awoke very often; had pains over both eyes, and profuse sweating during sleep. Another dose of Quinia bisulph. was given. Pulse, 95; temperature, 101°.

Power of pronation and supination, which had been lost, is returning, as is also that of flexion.

April 6th. Passed a better night. Slight headache night and morning, with pain in the right leg below the knee. Aconite, 2 grains, given every two hours.

April 7th. Good night; less perspiration; no neuralgic

pains in arm, but the pulse stood 102, and temperature 103°. Became restless; the arm was hot and swollen at the cut, which at 9 P.M. discharged a considerable quantity of healthy-looking pus.

April 8th. After the withdrawal of the pus the patient passed a good night. Pulse, 90; temperature, 100°.

April 9th. Good night; no neuralgia; pain in the cut; bowels moved normally. Pulse, 88; temperature, 100°.

April 10th. All symptoms of *petit mal* gone; no neuralgia; good appetite; can take hold of a piece of string, or pick up a pin from the table, which he was entirely unable to do for many weeks previously. Pulse, 90; temperature, 99°.

From this time he continued to improve very rapidly. He was at my house on May 25th, and is about going to the mountains for recreation. I may here state that he has yet occasional frontal headache, for which his physician advises most judiciously the use of Kali iod., as bearing upon his specific disorder. Comments on this case are not necessary. The only question now to be determined is the permanency of the cure.

I am of the opinion that in many cases relapses may occur, especially if there be several causes operating to produce them, or if adhesions between the neurilemma and the nerve fasciculi should again form.

In my second case of sciatic stretching, after three months of complete immunity from pain, without any premonition, the patient suffered from a severe attack of the "old pain," as she termed it, which was followed by pain and great stiffness in *both* knees. Upon examination the uterus was found much enlarged and retroverted, which no doubt was one factor in the production of the pain; a second being the severe attack of cerebro-spinal meningitis, from which she had previously suffered.

I believe that if the uterus can be restored to a proper position she will be materially benefited in *both* legs, from which she now so often suffers.

The first case in which the great sciatic was stretched for

traumatism, on December 14th, 1878, has been very materially benefited by the procedure. The patient has gained much flesh; the extreme sensitiveness of the limb has entirely disappeared; the sciatic pain has not troubled her in any way; she is out of bed all day, and walks with but one crutch, has an excellent appetite, and is in good spirits. She has taken no Morphia, either by the mouth or hypodermically, and really could often do much more than she allows. When it is remembered that she was confined to her bed for months, that to render her in any way comfortable 50 to 60 minims of Magendie were required daily, that the limb was perfectly immovable, and that when motion was applied the most excruciating pains were felt, and that there were spasmodic twitchings of the part, with hyperæsthesia so excessive that she could not bear the pressure of the bedclothing, the results of the operation are most satisfactory. She still has had, however, as I stated in my report, pains about the joint when she first goes to bed at night, which she has always complained of, and at times is hysterical. Thinking that perhaps a more complete cessation of pain might be produced by further operation, on May 18th I again stretched the nerve. An incision was made about one-fourth of an inch from the cicatricial line, which marked the former cut, and the nerve sought after. It was much more difficult to be brought to view than in any of the other operations I have performed. Cicatricial contractions and innocular tissues had glued together the muscles and fascia, and it was only after a quite thorough search in the exact locality where I knew the nerve must be that I found it, surrounded by connective tissue of considerable denseness. In fact, seen below this tissue it resembled tendon more than nerve tissue. The operation in this instance occupied twelve minutes—more than double the time required for either of the others. As the nerve was pulled upon the stretch, I distinctly felt it giving way in some portions of its course, and the tissue itself rather softer than usual, and the membrane was covered with fat.

Since the publication of my third case, in which the inferior dental nerve was exposed and stretched, and in addition neu-

rotomy was performed, I find the following record, in which neurectomy alone of the same nerve produced entire relief. The case is reported by M. Terrillon,* and is follows:

"A woman was subject to attacks of neuralgia in the right inferior dental nerve, which would be increased by the least touch, the action of speaking, of carrying a glass to the mouth, etc., and she became much emaciated. Incision being determined on, a double gag was introduced, while depressing the tongue gave room and light. A vertical incision running from the last superior molar to the inferior, divided the buccal mucous membrane as far as the anterior border of the tendon of the temporal. With the finger and a canulated sound a way was made between the internal pterygoid and the branch of the inferior maxillary. After a time the ridge of Spix, situate at the opening of the dental canal, is felt. The nerve is there, and it was divided, and immediately the patient felt relieved, and declared that since the operation she had suffered no pain, and she had all the appearance of health.

"My attention has also been called to the fact that Dr. J. G. Gilchrist,† of Detroit, successfully stretched the popliteal nerve for epileptiform convulsions and neuralgia. His case I had overlooked in my previous reports, probably on account of its title, 'Traumatism.' I must, therefore, in this place give priority to Dr. Gilchrist in our school in the operation of nerve-stretching. I insert the case here in full.

"The patient, a young man (æt. 25), some years before had sustained an injury to the right leg, a step of a buggy having torn the tissues in the popliteal space and penetrated deeply. There was no apparent injury to the artery, and he recovered with some cicatricial contraction, but the spot was very sensitive and the seat of more or less pain at all times. Soon after, he commenced to have epileptiform convulsions, with a sort of clairvoyant condition added thereto. These spasms became so frequent that he came under the care of Professor Gunn, of

* The Monthly Abstract of Medical Science, May, 1877, vol. iv, No. 5.
† The U. S. Medical Investigator, Sept. 1st, 1877. Whole No. 197.

Chicago, and underwent an operation by Nüssbaum's method, *i. e.*, exposing and stretching the popliteal nerve. For a few days he seemed better, but shortly the spasms returned with renewed violence and increased frequency. After a year or more he came under the care of Professor Jones, with whom I saw the case once or twice. His condition was then as follows: Bodily health good, looked robust, mind slightly impaired. The right leg slightly flexed, impossible full extension, temperature of limb normal. Had severe spasms once a day and oftener, which could be produced at any time by striking the popliteal space even slightly. There was a firm cicatrix, with much contraction in the popliteal space, quite sensitive to pressure or touch. Spasms would come on suddenly, with loss of consciousness and frequent grasping the head with the hands. During this time he would recite long poems, sing, propose conundrums, and declaim popular speeches, interrupted frequently by suddenly grasping the head and shuddering. Entirely oblivious to all external impressions, had no recollection of what had occurred on regaining consciousness. Nux vom., Hypericum and other remedies were given a fair trial, but no effect was perceptible. Stram. would frequently occur to Professor Jones, but for some reason it had not been given. Finally, at the request of Dr. Jones, the patient came to my clinic for surgical treatment. An Esmarch bandage was applied, the nodular tissue completely dissected out, the nerve slightly stretched, and a flap slidden over the gap. The popliteal artery was wounded slightly, and a ligature applied. The flap united promptly, and the case did well. The second day, on removing the dressings, it was found that the ligature had been cut off and retracted within the wound, which had been done by the patient's friends, who attempted to remove the dressings themselves. He had no return of the spasms for some days, when he had a slight attack. There was much pain in the leg, running down into the foot, which prevented sleep. Allium cepa and other remedies failed to remove this, which did not disappear finally until the knot of the ligature was discharged. Professor Jones, soon after the spasm alluded to, returned to

the preference for Stram., which was then given in the 30th attenuation. He had no return of the spasms, and now, fully six months after the operation, writes that he is able and has no trouble whatever, except a slight stiffness of the knee.

"What cured, of course none can tell. The presumption is that recovery could not have occurred without the operation, nor without Stram. to supplement it.

In order to ascertain the subsequent history of the patient, I wrote to Dr. Gilchrist, and have received the following answer in relation to the patient, together with further details of the operation:

"The nerve was involved in the cicatricical tissue, but did not seem altered at all. Some adhesion had formed underneath, but not very great. The stretching was, I should *estimate*, fully a quarter of an inch. One year afterwards he returned to my clinic with no trace of the former trouble but a slight contraction of the knee. Three months later he reported well in every respect; he had no *pain*, such as they usually have, but spasms of the same character quite frequently for a day or two after the close of my printed report. He has none, or had not a year ago, any abnormal symptoms whatever." I give also in this place the following interesting cases by Dr. E. Masing:*

A man (æt. 37) had been for the past eight years subject to neuralgic pains in the lower limbs. They commenced near the antero-superior spine of the left ilium shortly after exposure to cold and wet. Varied treatment only increased the pains. The muscles of his right leg became paralyzed, and soon after those of the foot. More recently there had been developing anæsthesia along the posterior surfaces of both limbs. Any movement would cause pain, which would generally commence near the left ilium; from thence extended to the lower limbs; the pulse was normal. Occasionally there were involuntary discharges of stools, and micturition was much impaired. A vertical incision—having been previously

* The Monthly Abstract of Medical Science, May, 1879, vol. vi, No. 5.

under chloroform—10 centimeters in length, was made from the fold of the buttock downwards along the posterior surface of the left thigh. The sciatic nerve, which appeared to be healthy, having been exposed and isolated, was then forcibly extended; at the same time a similar incision was made on the other side. In some weeks after—in the interim the patient suffering pain—the anterior crural was exposed and stretched; this operation was followed by general improvement, patient soon being able to walk well, and quite free from pain and anæsthesia.

The subject of another case was a boy, aged 12 years, whose left foot had been injured by a fall, all the toes having been bent at right angles to the dorsum; the muscles, also, of the left leg were in a tetanic condition. After other plans had been adopted, to no use, the left sciatic nerve was exposed and stretched, and was followed by contractions over the lower limb and by flexion at the knee. For many weeks he suffered much, but after subcutaneous injections of Morphia there was a temporary improvement, and after an interval of three months he was able to walk without crutches, and though there was much hyperæsthesia yet the boy's general condition was good.

Dr. Bird* also has had a most interesting case of sciatica, which had resisted all other treatment for months, which was caused by the same process which I have described. The patient was 56 years old, and had been in bed five months. Every variety of treatment had been resorted to without success. The doctor thus continues the case:

"The sciatic nerve was exposed by making an incision four inches long, commencing at the lower edge of the gluteus maximus muscle, and extending downward in the sulcus between the vastus externus and long head of the biceps cruris muscles. Parting the muscles with the handle of the scalpel, the nerve was exposed and raised by hooking the index finger under it. Tension to the extent of almost raising the limb was made

* Medical Record, September 28th, 1878, No. 412.

upon the nerve; this caused it to become slightly elongated, but giving way of tissue was not felt to have occurred during the stretching. The nerve was carefully replaced, and the wound closed with interrupted iron-wire sutures, and covered with a compress of soft, dry cloth retained with a roller. There was not a drachm of blood lost. One week afterwards the sutures were removed, the wound having healed without a drop of pus having formed. The pain was relieved as soon as the operation was ended; he could immediately lie upon his back, and even upon the right side. There was still contraction of the flexor muscles, which gradually gave way with exercise, which he began to take the second week after the operation. There was paralysis of feeling in all the muscles supplied by the sciatic nerve, that gradually left him, it being nearly six weeks before he was entirely free from it; the upper portion of the gastrocnemius muscle being the last to regain sensation, and the outer portion of the muscle the very last. As the paralysis disappeared the muscles would ache, not pain, for three or four days, when complete sensation would ensue. During his convalescence he was put on no treatment except careful dieting, by that means being sure that it was the operation itself that gave him relief. He now claims to be quite well."

In a late medical periodical I find also the record of three cases of tetanus treated by nerve-stretching; two of them died and one recovered.* It is my intention to bring these cases before the profession, as I am anxious that the exact value of the operation may be determined.

Article III.

THE OPIUM HABIT.

Its Treatment and Cure.

BY GEORGE F. FOOTE, M.D.

THE practice of opium-eating in some one of its forms or modes of administration, is pervading this country to an extent that is quite alarming.

I gather from the report of the Bureau of Statistics, that in 1869 there was imported through the Custom-House, in round numbers, 157,000 pounds of opium. This amount has steadily increased each year, amounting to 431,000 pounds in 1878, nearly three times the amount of 1869. To this should be added the products of our own country, as it is being cultivated in Tennessee and other of the Southern States, the statistics of which I have not been able to obtain; but it amounts to several thousand pounds.

It is fair to presume that some fifteen per cent. of this only is used in regular prescriptions by physicians, the balance, 366,350 pounds, is consumed by those addicted to the habit of opium-eating. Now in view of the fact that a single grain is the ordinary dose prescribed by a physician to relieve pain or to induce sleep, and that there are two billions, one hundred and ten millions, and one hundred and ninety-six thousand (2,110,196,000) grains in the amounts imported, we may begin to realize the amount used and the number of consumers that must be engaged in disposing of this enormous amount.

It is difficult for any one unaccustomed to the powers of this drug to imagine the sufferings superinduced by its use, or the injury sustained by the people at large.

The moral as well as the physical effect is not only telling upon the present generation, but it is at the same time entailing an hereditary curse upon the future.

The effect in appreciable doses varies according to the previous habits of the individual by whom it is taken, and in proportion to the quantity taken. Then again the continued use

apparently diminishes its effect upon the system, and the amount taken with seeming impunity by habitual opium-eaters is quite astonishing. The novice, if an adult, may take a single grain of opium, twenty-five drops of laudanum, or an eighth of a grain of the sulphate of morphia, with the following results:

As a primary effect "it increases the force, fulness, and frequency of the pulse, augments the temperature of the skin, invigorates the muscular system, quickens the senses, animates the spirits, and gives new energy to the intellectual faculties." This is followed by a "calmness of the corporeal actions, and a delightful placidity of mind succeeds; and the individual, insensible to painful impressions, forgetting all sources of care and anxiety, submits himself to a current of undefined and unconnected but pleasing fancies, and is conscious of no other feeling than quiet and vague enjoyment, until finally he becomes lost in sleep." This soporific state lasts from eight to ten hours, and is usually followed by nausea, headache, with nervous depression, which, in a healthy person, the system is able to throw off in a few hours. But where these effects are complicated with disease, to allay the pains of which opiates may have been taken, then there usually occurs a demand for an increased quantity before comfort even is attained.

But as a person becomes confirmed in its use, this primary delirium with its pleasurable emotions is felt only in a small degree, and of those who have attained to the use of larger doses it is not felt at all. But in its stead a relief from suffering ensues, with a sort of business activity, that enables the recipient to engage in his daily occupation with more than his accustomed energy. His mind is clear and apparently well balanced, his appearance is above reproach, and to those who only see him in this condition, unless they are experts, he appears like any ordinary person possessed with an enlarged energy of purpose. He is not over-voluble, but his language is forcible, and he carries a weight in his tone of voice that implies a full share of the will-power. But this phase of opium-eating passes off in ten or twelve hours, and then follows a train of symptoms peculiar to this poison and known as its secondary effect.

In this state all the sufferings that flesh is heir to seem to be concentrated, at least so the victim of this habit imagines. But from this condition there is no possible relief except by a repetition of the dose with a slight increase in the quantity. By this increase the habit grows, and the system becomes enabled to bear as a daily ration a quantity that would poison and destroy the life of several persons if divided among them. We have had patients under treatment for this trouble who were taking twenty grains of the Sulphate of morphia at a dose. To comprehend the enormity of this amount it is necessary to bear in mind that one-eighth of a grain is an ordinary dose, sufficient to put an adult to sleep, and then multiply eight by twenty, and your product shows that this patient had acquired a capacity to receive into the system 160 doses with comparative impunity, a quantity sufficient to produce an everlasting sleep upon several persons unaccustomed to its use. Forty and even sixty grains at a dose are recorded as having been taken by others. This demonstrates the wonderful economy of the human organism by which it can adapt itself to extreme measures by a graduatory process. The same phenomenon occurs with those who use tobacco as a daily habit. The quantity consumed by some smokers or chewers with apparent impunity would be sufficient to poison a novice in this habit. It is not an uncommon thing to find inebriates with a capacity to take from one to two quarts of whiskey as a daily allowance and still live, and attend to their daily occupations. The consumers of the betel nut, the cocoa, and even of arsenic, display wonderful powers of resistance against the poison of these drugs, powers acquired by a slow but daily increase of the amounts taken.

The secondary effects of opium are very marked and decided in their expression. If the first effects are characterized by pleasurable emotions, the second are the opposite of any feeling that the imagination can picture as a part of the first. Among these effects are noted throbbing and congestive headaches, trembling and twitching of the facial muscles, with glassy and restless eyes, mouth and throat dry and feverish, with some difficulty in swallowing, great thirst, loss of appetite, with

nausea and vomiting, indigestion, heartburn and colic, diarrhœa alternating with constipation, twitching of the extremities with numbness and paralysis, oppression of the chest, stupefying and unrefreshing sleep, sleepless nights, coldness of the limbs, chill and heat accompanied with exhaustive perspiration, stupefaction of the senses, illusions, fright, great grief, with imaginary want of sympathy and kindness, and if no relief is obtained many of the damnable horrors that accompany delirium tremens.

These are the symptoms predominating after the first effects of the opium have subsided and the reaction is felt. In this state the torture now experienced by the habitual opium-eater is beyond the power of language to describe. No one can appreciate it without having felt it. While trying to abstain from repeating the dose, the patient endures more or less of those symptoms which excite him to cowardly madness, causes him against his better judgment to seek the only relief which he knows to be positive, though temporary and hurtful, and he ends his suffering for the time by a return to his habit, while he increases the quantity and the difficulty that is sure to as a sequence. He is now a slave to a habit over which he has no control and which he cannot abandon. Self-control is not one of a man's qualities while victimized by opium. He is not competent even to the self-administration of his daily dose without gradually increasing the amount. The habit formed becomes irresistible, while its growth is insidious, commencing usually with the doctor's prescription, which, though soothing at first, leaves a train of painful symptoms that can be appeased only by yielding to the demand for more in increased quantities. This is repeated, and before the recipient is aware of it he is a victim to an enslaved and unnatural appetite wholly beyond his control.

It may seem strange to the uninitiated that a person addicted to this habit, fully realizing all the horrors connected with its indulgence, and that too confirmed by a large experience, has no control over this appetite. But every case is but a confirmation of past experience which tells us that the opium-eater

has lost his freedom, that he is a slave to an unseen power that controls his insatiable desire. His master is inexorable and governs him with the direst penalties, mental and physical.

The opium-eater requires no argument to convince him of the errors of his habit. He is far more conscious of the evils and the absolute necessity for a change than his best friend can be. And it is painful to witness his oft-repeated attempts at reform, which are sure to end not only in a failure but in an increase of the difficulty, and the friend who insists upon coercion without the aid of the curative means that experience has proved available is a monster of cruelty, either without feeling or blind to the tortures that in his stupidity he is unable to comprehend.

The fact being admitted that the confirmed opium-eater has a disease which creates a demand for opium which amounts to a necessity for its use, and that this demand is so imperative that it is wholly beyond his powers of resistance, what then is is the remedy? Now experience teaches us that the use of opium cannot be abandoned suddenly without great violence to the system. Any attempt of this kind by compulsion or otherwise induces the most horrible sufferings, which, if persisted in, may end in death from exhaustion or suicide. Nor can any other drug be substituted that would be less injurious.

If arsenic is introduced into the stomach and is immediately followed by the hydrated peroxide of iron, the iron combines chemically with the arsenic and produces a substance comparatively inert. Corrosive sublimate when taken as a poison is neutralized by the free use of albumen, with which it unites to form a comparatively harmless compound. Alkalies are neutralized with acids, etc. But these inorganic substances have their well-known reactive agents.

Opium is from an organized body without any known reactive agent. Its combinations of atoms are made up in the laboratory of the vegetable kingdom, where vital forces are the elements of power, at the portals of which our savants bow in wonder and amazement, but are unable to solve the mysterious workings of the unseen power within. Indeed, there is no

chemical antidote to opium that has been taken into the system, because nothing will combine with it to form a neutral compound.

This law holds good in regard to the stimulating properties of alcohol. Nothing will combine with it to neutralize this essential principle. We may add another stimulus that in its power may appeal so strongly to the senses as to divert the attention from the former, nevertheless the former exercises its full power in proportion to the quantity taken; a power that in its exaltation is sure to be followed by a corresponding depression. As certain as a bent spring is to fly back to and beyond the point of rest to a distance nearly equal to its starting-point, so must the depression below the normal condition of the system equal the exaltation produced by any unnatural stimulants. We cannot even combine alcohol with any substance that will neutralize its intoxicating properties.

The reader must bear in mind that there are two distinct laws in force here, one chemical the other vital. Of these we avail ourselves of the former to anticipate the injury that might arise from many of the inorganic substances while *in transitu* in the stomach before they have been absorbed into the general circulation. But the other law deals with organized forces, and does not recognize chemical affinities. By this law recuperative powers are set in motion after the injury is sustained. The former is the preventive that does its work before the injury, but has no curative action upon tissues already suffering. The latter is the great *vis medicatrix naturæ*, that is ever in the effort to build up and restore to a normal condition so long as life lasts. Opium is not subject to the former law after being received into the system, therefore it has no antidote. A chemical antidote is really a preventive against mischievous consequence, not a cure for an already established illness or disease. A man that takes opium may expect the consequences with as much certainty as he may expect to be burned if he puts his hand into the fire.

The only possible way to cure this disease is by a retroceding course in the order in which the habit has been formed.

As for example, during the process of creating this disease, a certain amount of time has elapsed during which the dose has been gradually increased from the former minimum to the present maximum quantity. Now the only means of cure is to reverse this order, and gradually diminish from the maximum to the minimum dose. As no violence should be done to the system by any sudden change of its habits, this retrocession must be slow, while the retrenchment should be periodical, with sufficient intervals for the system to become familiar or accustomed to the amount given before another diminishing step is taken. All attempts at a cure of this disease must be based upon this law of gradation, all others are inoperative and dangerous.

But the trouble with most opium-eaters is that they have no self-control, no power of restraint. It is a disease that impels them to increase rather than decrease the dose; they are victims to a power that overwhelms their better judgment with a desire for temporary relief. The oft-repeated attempts to abandon the use of opium without gradation is accompanied with more or less of the sufferings herein described, and invariably terminates with the taking of increased quantities. But even the process of gradually diminishing the dose requires the presence and skill of an experienced physician who has made this a special study. The patient should be separated for a time from the sphere and influences that have surrounded him while forming and indulging the habit; he needs absolute rest from all business and all mental effort, and should have the best sanitary care and control. He needs the encouragement of a physician in whom he confides his every action and thought, as much as he needs the proper medical treatment to meet and relieve the numerous affections that accompany this infirmity. He needs the moral influence of the proper surroundings to be had only at a "home" devoted to this cure. Therefore the true remedy for the opium-eater is to place himself in such a home. There he will find confiding friends who will administer to his necessities with the kindest care. There he can exchange ideas with others similarly affected and feel en-

couraged by the presence of those who have met and conquered the enemy, and who are about to try the realities of life full of hope and self-reliance. At such a home the physician carefully watches and directs the administration of the drug in its imperceptibly diminished quantities, carefully meeting each and every symptom with some soothing treatment that his experience has found available. There he will be surrounded by facilities for occupying the mind and keep it from the contemplation of his own sufferings. There he should stay a reasonable time, while in the most careful manner the quantity of the dose is reduced to zero, and his system is thoroughly renovated through the recuperative powers of nature, assisted by proper medicaments, good hygiene, and good moral influences. And if added to this he is exposed to trials and temptations by familiarizing himself with the poisons that have engendered this disease, until they have lost their seductive power to tempt him, he will return to his friends a new man, and in a condition to fill up the measure of his days by a life of usefulness.

To this we will add that there are many curious anecdotes told of opium-eaters. All are willing to acknowledge its baneful influence, while few, if any, ever attach any blame to themselves for having acquired the habit.

Some there are who take it for its ecstatic effect alone, others for its increase of vital energy, whereby they are enabled to perform an enlarged amount of mental labor, others take it to relieve pain. Those to whom from long habit it has become second nature, take it because they are obliged to—they cannot live without it.

Mr. B., a literary man, with a well-earned reputation, became, in course of time, an experienced prover of the effects of opium. Justifying himself in having formed the habit in a serious illness, when relief from pain was only obtained by the administration of this narcotic, he deplored the necessity for its use while he made frequent attempts to abandon it. But each attempt was accompanied with direful sufferings that compelled him to return to this drug with a necessity for an enlarged dose before he could obtain the accustomed relief.

Having met with losses from a neglect of business, the result of his bad habit, he once again resolved to abandon it, after being importuned by his friends to do so, and particularly by his wife, who, though orthodox in her religion, could never persuade herself that her husband was predestinated to a life made useless by opium. Embracing the present opportunity as a fitting occasion to correct a great evil, she was strong in her denunciation of the vice, portraying its consequences in language too emphatic to be misunderstood. She believed that the only way to be regenerate was to abandon the source of the evil, and that too without temporizing with the enemy.

Under all this pressure Mr. B. fortified himself with a dose of sufficient size to impress him favorably with the enterprise, and finding his courage rising he resolved, and added strength to his resolution by a moderate oath, that he would never, never touch the accursed stuff again, no never. "Hold fast to that resolution," said his wife, "and you are safe." "I will," he responded, "and I can assure you that the prospect of escaping from the prison that has so long deprived me of my true liberty gives me new life and energy."

"Bravo!" responded his wife, and "Bravo!" repeated his friends, and all were filled with an enthusiastic belief that the time of deliverance had come. A belief fathered by the desire rather than by experience or knowledge.

Thus encouraged he went forth to his business cares with an ambition worthy of the model man of the age. His friends rejoiced at the manifest strength of body and energy of purpose, and for several hours matters pertaining to this new relation went on smoothly, filling their hearts with hope and gladness. But after a time the sustaining effects of the opium began to disappear, giving place to the secondary symptoms with their indescribable horrors. Then began a warfare within and without, both mental and physical, in which the demand for more opium to sustain the flagging energies of the system was met by a determined opposition of the will of the patient, sustained by the judgment and influence of his friends.

Skirmishing with the advance guard, sustained by the pride

of self-reliance, the desire to retain the good opinions of his friends, and the hope of success, he held his ground and kept the enemy at bay for a time. But his defensive points were weakened by continued charges, and he suddenly found that he was completely surrounded and himself a target for the grape and canister of an enemy that gives no quarter, and allows no terms of peace except upon unconditional surrender.

What was he to do? There stood his friends watching with interest the result of the conflict. There was his wife, to whom he had resigned the bottle containing the bane of his existence, and who, in her eagerness to make the result so desirable certain, had triumphantly consigned the contents to destruction, hoping thereby to cut off the only avenue of a shameless retreat, determined in her every look that he must succeed this time or "she would know the reason why." He must and should stand up like a man clad in full armor without hope of escape except by conquest.

There he stands, the picture of a forlorn hope, enemies within, who are torturing his soul with diabolical excitations; friends without, whose displeasure he dreads, and whose approval he is anxious to retain; yet what a fight for the goal that is scarcely visible in the distance, to reach which he must alone meet and subdue an innumerable host of tormenting spirits sent out from pandemonium to cross his path.

He casts a wistful look behind, but there is no escape, no hope in that direction, and he girds his loins and tries to persuade himself that his good resolutions will yet sustain him, while he calls up his remaining fortitude and tries to brave the foe. But it is a final attempt. His tormentors are pressing him sorely, and undermining his cherished hopes. His face is pale and elongated, his eyes sunken and glassy, his limbs trembling as with palsy; he is a picture of distress, driven as by a whirlwind into indescribable anguish, in which all the horrors of hell seem concentrated.

The picture falls far short of the reality, which is only understood by those who have felt it. The longing for relief, the desire for the "drop of water to quench the parched

tongue," the constant recurring of the thoughts to the one source of hope, now forcibly placed beyond his reach, seem driving him to madness.

Steadily the sufferings increase until the last sheet anchor of hope is broken, and in the agony of despair he cries out, "The torments of hell are upon me, give me opium, and let me die."

But "the laws of the Medes and Persians are irrevocable." The edict has gone forth and the strong-minded wife kindly, but firmly, declines to interfere with the process of what she, in her stoicism, deems to be the only positive cure. Her philosophy that to avoid being burned one must keep out of the fire, and being already burned is no sufficient reason for additional exposure.

In the agony of despair he paces the floor wringing his hands and smiting his breast. Suddenly stopping he raises his hands in an imploring attitude and cries out: "This is intolerable, I can bear it no longer. I must, I will have opium!"

Then begins a dramatic scene between the opium-eater, frenzied with an intense desire for relief that opium alone can give, and the injudicious but conscientious wife, with criminations and recriminations over which we will draw a veil.

The sequel shows that in the intensity of his excitement the physical succumbed, and a swoon relieved the victim for a time by unconsciousness. Falling heavily upon the floor, consternation and alarm took possession of his friends.

The physician being summoned, prescribed the needful opium, to which the now anxious wife no longer objected. And thus ended the farce, as *all similar* attempts to abandon this habit suddenly must end, that is, by returning to the use of opium.

ARTICLE V.

CEREBRAL ANÆMIA.

Its Varieties and Treatment.

BY J. MARTINE KERSHAW, M.D., ST. LOUIS.

IN cerebral anæmia there is either a very much less quantity of blood in the brain than is ordinarily present in health, or the quality of the blood is poor. The anæmia may affect the general cerebral substance, or it may be confined to a particular portion of the brain. The affection may be acute or chronic. The varieties of cerebral anæmia are as follows: 1. The acute form—the fainting ordinarily observed after severe shock or hæmorrhage. 2. The chronic form. 3. An infantile form—the not uncommon affection known as hydrocephaloid. 4. The localized or parietal anæmia due to obstruction of the cerebral vessels. Of the acute form I shall say nothing further in this paper, but proceed to the consideration (1) of the chronic form, (2), of the infantile form, and (3) the partial or local variety.

CHRONIC CEREBRAL ANÆMIA—SYMPTOMS.

A patient of this class is generally poorly nourished, weak, and debilitated. She is disinclined to move, complains of headache, vertigo, noises in the ears, backache, palpitation of the heart, indigestion, loss of appetite, and constipation. There may also be loss of memory, great depression of spirits, hallucinations of sight and hearing, well-marked cutaneous anæsthesia, small weak pulse, distinctly marked anæmic murmurs heard at the base of the heart, dilated pupils, and great drowsiness. The skin is ordinarily pale and cold, there may be puffiness of the hands and feet, and the urine is sometimes albuminous. A subject of this complaint naturally assumes the recumbent posture, and every attempt at exertion of any kind requires great effort, and is attended by a general aggravation of the symptoms of the disease. Drowsiness, as already remarked, is a prominent symptom of the difficulty under con-

sideration, and a patient will not unfrequently fall asleep in a street-car, a carriage, a chair, at the dinner-table, or indeed in any place where he is afforded a few moments of uninterrupted rest. Now, although anæmia is the great cause of the difficulty under consideration, and the recumbent posture generally brings with it an abatement of the symptoms and very sensible comfort, yet sleeplessness is not an uncommon attendant, and proves a very persistent and distressing symptom. A prominent author says:* "In instances of medium severity the patient readily falls asleep in the sitting posture, but recumbency induces wakefulness from the fact that the quantity of blood in the brain is thereby suddenly increased above the habitual standard, and a state of comparative hyperæmia is induced." Under the title of "*Neurasthenia*"†—nervous exhaustion—Dr. Beard gives his experience in the treatment of a number of cases, several of which were evidently cases of cerebral anæmia, especially those classed under the head of "*Cerebrasthenia*."‡ In his article on "vertigo" Dr. Ramskill mentions cases that should be classed as cases of cerebral anæmia. He says: "Vertigo from overwork ranks next in frequency to the stomachal variety. It occurs in young persons who are underfed as well as overworked, as in some seamstresses; in the middle-aged, who, owing to spare diet and various irregularities, ... are constantly subject to mental anxiety and excitement. . . . . Patients complain of a want of clearness of intellect, an incapability of sustained mental exertion, together with occipital heaviness or headache. . . . . In the worst cases irritability of temper, restlessness, a sense of impending evil, and more rarely insomnia, are added. . . . . This is the form of vertigo which most often amongst business men precedes softening of the brain." In the case of a prominent business man who lately consulted me, suffering from both cerebrasthenia (cerebral exhaustion) and myelasthenia (spinal exhaustion), sleeplessness was a marked and very annoying symp-

* Hammond, Diseases of the Nervous System.

† St. Louis Medical and Surgical Journal, May, 1879.

‡ Reynolds's System of Medicine, vol. ii.

tom. While under the care of another physician he was given the Bromide of potash and Chloral with the result of aggravating and intensifying all his symptoms. Vertigo, noises in the ears, profound depression of spirits, with a strong suicidal tendency, were prominent features of this case. Fits of crying were also common at all times, but especially during the periods of dreadful mental depression which he experienced. A lady now under my charge, suffering from the disease in question, has attacks of vertigo on very slight change of position if the change is not made slowly. She staggers quite a good deal in walking, and therefore walks as little as possible, finding herself the most comfortable in the reclining position, or seated in a large softly-cushioned arm-chair. She dozes readily while sitting, but sleeps very little at night. She eats scarcely anything, the skin is pale and cold, there is dimness of vision, noises in the ears, an inexpressible vacant feeling in the head, and great loss of memory. With regard to the hallucinations observed in some cases,* Dr. Hammond relates the case of a lady who sees a black man near almost constantly. "At times she converses with this imaginary being; tells him not to trouble her; that she no longer fears him," etc.

CEREBRAL ANÆMIA.	CEREBRAL CONGESTION.
Patient weak and debilitated.	Patient of full habit.
Drowsiness a prominent symptom.	Wakefulness a prominent symptom.
Dilated pupils.	Contracted pupils.
Head troubles relieved by the recumbent posture.	Head troubles aggravated by lying down.
The ophthalmoscope shows retinal anæmia.	The ophthalmoscope shows the retinal vessels to be more tortuous and increased in size and number.
Pulse weak, irregular, and rapid.	Pulse slow, full, and strong.
Skin pale and cold.	Skin flushed and warm.

INFANTILE CEREBRAL ANÆMIA—HYDROCEPHALOID.

Symptoms.—A strong, healthy, robust child does not suddenly become a subject of this disease, but one that, through an inherited faulty constitution, is weak and debilitated, or one

* Diseases of the Nervous System.

that, as a result of insufficient nutrition or exhaustive disease, becomes delicate and feeble. It is the underfed, exhausted, poorly-nourished child that becomes an easy prey to cerebral anæmia. Dr. Marshall Hall divides the complaint into two stages: 1. The stage of irritability. 2. The stage of torpor. In the first stage the child is cross, feverish, and very restless; the skin is hot, the face flushed, and the pulse small and frequent; it starts and jumps at every sound, frequently screams suddenly, or sighs and moans during sleep; the bowels are loose, and the urine is diminished in quantity. In the second stage the child becomes stupid, the eyelids partly close, it ceases to notice those about it, and the pupils are unaffected by light; the skin becomes cool, and the anterior fontanels, if not closed, become depressed; the screaming ceases, it sighs frequently, and its breathing is irregular; the voice becomes weak, an annoying irritable cough is sometimes present, the diarrhœa still continues, the urine is suppressed, and, as the exhaustion continues, coma ensues, and finally death. The differential diagnosis of hydrocephaloid and meningitis (which it most nearly resembles) is given by Dr. N. R. Morse* as follows:

HYDROCEPHALOID.	TUBERCULAR MENINGITIS.
1. *Age.*—*Usually* under one year of age; *rarely* over two.	1. *Age.*—Rarely under one year of age; usually from two to eight years.
2. Disease may appear as an epidemic; rare except during the summer and autumn.	2. Disease sporadic; occurs at all seasons.
Mode of Invasion.	*Mode of Invasion.*
3. Follows after some exhausting disease, such as diarrhœa, etc.	3. A primary disease, ushered in by well-known prodromic symptoms.
4. *Symptoms.*—Vomiting and diarrhœa, with rapid exhaustion of vitality.	4. *Symptoms.*—Headache, vomiting, and obstinate constipation.
5. Fontanels depressed and motionless.	5. Fontanels prominent and frequently pulsating.
6. Pulse feeble and rapid, but regular.	6. Pulse *irregular*. At first accelerated, then retarded, and finally greatly accelerated.
7. Abdomen normal or tumefied.	7. Abdomen retracted and boat-shaped.

* Transactions American Institute of Homœopathy, 1877.

Local or Partial Cerebral Anæmia—Embolism—Thrombosis.

It is not my purpose to write a paper on embolism, thrombosis, aphasia, or on the subject of hemiplegia, but to call attention to the first two, as causes of anæmia of the portions of the brain in which they are located, and the aphasia and hemiplegia as consequences of the cerebral circulatory disturbance.

Embolism.—When a clot of blood, or fibrin, or other substance is thrown off from some part of the circulatory apparatus, and ascends towards the brain, it finally reaches a point in the cerebral vessel which is too small to admit of its further progress with the result of suddenly plugging up the vessel. The immediate consequence of the arterial closure is anæmia of the parts beyond the point of lesion. If the vessel is a small one, and the collateral circulation is easily and quickly established, the troubles following may not be of a grave nature; but if the middle cerebral artery, or some other large vessel afford a lodgment for the embolus, the symptoms are suddenly pronounced and are of a serious nature. There are, ordinarily, no prodromatic symptoms, but the patient, if standing, suddenly falls to the ground, and, on inspection, is found to be unconscious. On the return of consciousness he is found to be paralyzed on the one side of the body—usually the left. The loss of motion may be complete, or only partly so; or the tongue and face may be the only parts affected. Ocular troubles may also be present—strabismus, ptosis, dimness of vision. If the middle cerebral artery of the left side be the one occluded, aphasia, or the loss of language, will be found to exist as a result of lesion of this particular part. This, together with the hemiplegia, are the usual prominent symptoms of embolism of the middle cerebral artery of the left side, the portion of the brain in which in the majority of cases an embolon lodges. Softening may also follow in the parts deprived of their usual blood supply.

Thrombosis.—The symptoms of thrombosis develop very slowly, and are due to the gradual closing of a vessel. Deposits of fibrin or other matter take place on the inner side of the vessel, and in a gradual manner its calibre is diminished, until finally the vessel is entirely closed. The consequence of such closure is anæmia of the parts of the brain supplied by the affected vessel beyond the seat of the thrombus. One vessel may be affected or several. A pretty constant symptom is headache, not very severe, perhaps, but persistent and confined to one spot. Vertigo is also a symptom generally present. Dilatation of the pupil of the affected side has been noticed in some cases. Difficulties of speech are noticed early in the disease and become marked as the affection advances. They are shown in some one or more of the forms of aphasia. Sometimes it is the ataxic form—the difficulty being an inability to coördinate the tongue and lips properly, not from incoördination simply, but a degree of paralysis also. The amnesic form may prominently affect the patient, the difficulty consisting in the loss of memory of words. The subject may know perfectly well what he desires to say, but he cannot call to mind the words necessary to express his wishes. In many cases the intellect is perfectly clear; in numerous others, however, great loss of memory is a prominent feature of the complaint. Paralysis also gradually follows, as the vessels become occluded, slowly advancing as the changes go on in the vessels, with the consequent anæmia beyond. There may be periods of remission, but as the vascular changes take place the paralysis extends, until finally an entire side of the body may be more or less paralyzed. Softening frequently follows long-continued anæmia due to thrombosis.

Causes.—Frequent and profuse uterine discharges are common causes of cerebral anæmia, quickly following miscarriages and abortions, as also the pernicious practice in which some women indulge of taking powerful drugs each month before the period to insure its return—these strongly predispose the patient to the disease in question. Long-continued leucorrhœa, excessive nursing day and night, dysentery, diarrhœa,

bleeding hæmorrhoids, epistaxis, long-continued fevers, especially the very unmanageable malarial fever so common in this Western country, and the constant drain from old abscesses. Over-mental work, night-work, night-watching, all kinds of excessive study—the brain doing duty constantly, the body comparatively nothing—such a course tends, first, to hyperæmia of the cerebral substance, followed latter on by the reaction—exhaustion—which is anæmia. Dr. Hammond has known the application of Jounod's boot to cause cerebral anæmia. The abuse of certain drugs, such as Chloral, Bromide of potash, etc., has not infrequently brought about the condition of the brain under consideration. I have had several cases under treatment in which the difficulty was due in great part to the use of the drugs named. Nor is this surprising, considering the number of people who take Chloral with almost as much regularity as they take their meals, and that the Bromide of potash is kept in some families in large bottles, to be taken *ad libitum* whenever any member or friend has a slight headache. Insufficient nourishment, the continuous use of tobacco in some people, and want of fresh air and sunshine. Ligation of the carotids is mentioned as having caused this disease. Aneurism, the pressure of tumors and enlarged organs on the ascending vessels, these may also be considered as causes of the difficulty. I had almost overlooked another cause of cerebral anæmia, and that is the frequent use of chloroform. Numbers of women use it for the purpose of inducing sleep, and it is commonly used by some women every month to allay the pains of menstruation. I call to mind one case who habitually went to bed with a handkerchief and a bottle of chloroform. Dr. Hamilton * mentions a case in point. He says: "I can recall the case of a young lady who confessed that she had been in the habit of putting herself to sleep at night with chloroform, besides inhaling it several times during the day. I have never seen such a typical case of this morbid condition. Her skin was of a hue of waxy whiteness, her pulse small and fluttering,

* On Nervous Diseases.

her pupils widely dilated, and her languor and muscular feebleness very profound. Depression and the contemplation of suicide prompted her to confess her bad habit." In cases of infantile anæmia, many of the above-mentioned causes are at the bottom of the trouble, the principal of which are exhausting diseases, diarrhœa, obstinate vomiting, etc., improper or insufficient food, the mother's milk being poor in quality or diminished in quantity, or both. Besides the already mentioned causes, there is frequently another—a deeply hidden constitutional taint—weakness, which, with time, develops itself, and it may be in the form now under consideration. As principal causes of partial cerebral anæmia may be mentioned embolism and thrombosis, to which attention has already been called, tumors of the brain, aneurisms of cerebral vessels, old age, an atheromatous condition of the vessels of the brain favoring thrombosis, a rheumatic diathesis, organic disease of the heart, fatty degeneration of the heart, and aneurisms of the aorta or other large vessel favoring embolism.

Diagnosis.—The differential diagnosis of infantile cerebral anæmia and tubercular meningitis, and chronic cerebral anæmia and cerebral congestion, have already been given. The mode of onset and general history of both embolism and thrombosis have been clearly noted, and careful attention to the several prominent symptoms of each disease will prevent a misconception as to the nature of the complaint.

Prognosis.—The chances are in favor of recovery in many cases of chronic cerebral anæmia, if the cause can be removed. The prognosis is grave in those cases due to sudden and great losses of blood. Cases of infantile cerebral anæmia are always of a grave nature; but if the disease is not too far advanced, if the cause can be removed, and the surroundings made in accordance with the needs of the child, much may be done for these cases. The prognosis in cases of partial cerebral anæmia is generally bad, although if the patient lives for four or five days after the shock resulting from embolism, he may recover. There is always a strong probability, however, that softening will set in in these cases, especially in those due to obstruction

of large vessels, where the extent of anæmia beyond the seat of lesion is great.

Morbid Anatomy and Pathology.—Of the pathology of the varieties of the disease just described, it is unnecessary to say more than has been already given while noticing the history and general symptoms of the difficulty under consideration. The pathology of each variety has received general attention in describing the particular difficulty. A more detailed account would be more than the limits of this paper would permit of.

Treatment.—In the treatment of this affection, as in every other difficulty, the cause should first, if possible, be removed. Uterine hæmorrhages, the bleeding of hæmorrhoids, leucorrhœa, the drain of continued nursing, diarrhœa, dysentery,—these should receive attention at once, as the continued activity of one or more of these troubles will defeat any ordinary measure applied for the relief of the patient. Rest is what most of these patients need, and nature is, in the majority of cases, forcing them to this, as is observed in the difficulty of breathing, the ease with which they become generally exhausted, and the drowsiness which overcomes them so readily at all times and in all places. Some of these people should lie down almost constantly, others should take quite a good deal of exercise, some should quit business, while others should continue at some occupation. Some will recover under rigidly enforced idleness, while others will rapidly grow worse under such a mode of treatment. Travelling benefits some cases, while others are certainly much better at home. The rest-treatment in each case will depend altogether upon the individual, his temperament, habits of life, occupation, etc. In severe cases the patient should be placed in bed and kept there. The blood-supply, upon which his mental and physical activity depends, is lacking both in quality and quantity, and therefore the less run he makes upon his weakened capital the better. The recumbent posture, Mitchell's rest-treatment, good, nourishing food—fish, eggs, meats, whiskey, and wines, in some cases—salt-water baths, massage, electricity, all then should be borne in mind in the treatment of this affection, but applied according to

the needs of each particular individual. Electricity is, however, one of the most important of all remedies, and will generally be required in most cases. I use it constantly in this class of complaints, and can testify to its great efficacy in the treatment of this disease. Dr. Butler* also records several cases in which the treatment by means of this agent was all that could be desired. The same general treatment should be employed in treating cases of partial cerebral anæmia due to embolism, thrombosis, or any growth, tumor, or other substance, obstructing the cerebral circulation. In the treatment of cases of infantile cerebral anæmia, the greatest care should be taken to see that the food is good. Sometimes the mother has not enough of milk, in consequence of which the child fails to get enough to eat; in other cases the quality is poor, although there may be an abundance of fluid. In many instances it is quite as necessary to treat the mother as the child, and this should never be lost sight of in treating a case of this disease. A partially retracted nipple will sometimes keep a child hard at work all the time, and yet it will fail to get sufficient to satisfy its hunger. With regard to the eradicating of constitutional taint, which is often at the bottom of difficulties of this nature, Grauvogl's *ante-natal* treatment; the administering of sulphur and calcarea phosphorica to the mother several months before the birth of the child, is to be commended. In all cases the child's strength should be kept up from the very first. It should have natural food if possible; if not, give it that artificial food which seems to agree with it the best. Bathing with whiskey and water, or salt and water,—these stimulate the child, and help it to bear up under the tendency to waste *medicines.*

Argentum nitricum.—Great mental depression, apathy, and indifference; loss of memory rapid and extreme, the patient being reduced almost to idiocy in some cases. There is a deeply-seated and constant headache, and there is an utter inability to do any mental work. The sleep is disturbed and dreamful. There is a great physical prostration, with general

* Electro-Therapeutics and Electro-Surgery.

trembling of the muscular system. There is a tendency to paraplegia, general spinal tenderness, and neuralgia affecting the infraorbital branch of the fifth is common. It is a precious remedy in the chronic form, and is also of service in the infantile variety.

Zincum.—A remedy very much like the preceding. The memory fails rapidly, the patient talks in a silly manner, the skin is cold and of an earthy color, there is a tendency to muscular waste, and there is spinal tenderness. The tongue is coated, the bowels constipated, while there is a restless, fidgety condition of the lower extremities, which keeps them constantly in motion. The anterior fontanel is depressed in cases calling for this remedy. In cases of cerebral atrophy, with great mental depression, this proves a valuable remedy. A case now under treatment, who suffers from great loss of memory, vertigo, staggering gait, and almost entire want of appetite, is improving gradually under the influence of this remedy. Zincum may be called for in both chronic cerebral anæmia, and in the infantile variety.

Phosphorus.—This is a prime remedy for old cases of long standing, and is all the more indicated if the patient is advanced in years and arterial degeneration is taking place. It is one of our best remedies for cerebral softening, a condition due to anæmia, or insufficient blood-supply of particular portions of the cerebral substance. Neuralgia of the fifth pair, left side, would be an indication for this remedy. Cases of cerebral anæmia, associated with sexual debility due to long-continued excesses, are rapidly benefited by the use of phosphorus. A tendency to tuberculosis, early morning diarrhœa of a watery character, the fluid discharges being covered with cherry-like bodies, and vomiting within a few moments after drinking, these are reliable indications for this remedy. Both the chronic and infantile variety call for phosphorus.

Phosphoric acid.—This remedy is called for in cases similar to those where phosphorus is indicated, but it seems that the general debility is more extreme, the sexual weakness more profound. Very debilitating clammy nightsweats, and chronic

diarrhœa of whitish-gray stools. Many of the symptoms are due to prolonged sexual excesses, especially masturbation. Very low-spirited, with dull, crushing headache affecting the vertex, continuing day and night, so severe that the patient is unable to think; this strongly points to phosphoric acid. Should be used in both varieties.

Calcarea carbonica.—Indicated in scrofulous patients. The child's flesh is flabby, the fat lacking in firmness. The fontanels are slow in closing, the head is generally wet with perspiration, the abdomen large and protuberant, the milk curdles and is vomited, and the food is undigested. An almost indescribable vacant feeling in the brain, a feeling as though one would lose his mind; palpitation of the heart on the least exertion; very annoying vertigo; tendency to glandular enlargements, and a general derangement of the assimilative processes are indications for the remedy. Both varieties will at some time call for this remedy.

Æthusa cynapium.—Is especially indicated in the infantile form where there is extreme prostration; the child vomiting the milk almost immediately and in large curdled lumps; diarrhœa of greenish mucus; pupils dilated; and the child lying in a semi-stupid condition.

Arsenicum album.—Great prostration, great anxiety, fear of death; chronic diarrhœa, with discharges of a burning character; cold, clammy skin; great restlessness; constant thirst; all the symptoms worse at night; nausea, vomiting, and purging immediately after drinking. Indicated in cases following acute exhausting diseases, malarial fevers, and cinchonism. Used in both varieties.

China.—To be used for the debility consequent upon exhausting acute disease. The patient gets well, but an extreme anæmic condition remains which finds its remedy in china. It should be used for the debility resulting from long-continued nursing; uterine and other hæmorrhages; frequent sexual emissions, masturbation, sexual excesses, etc. Vertigo and amaurosis are also indications. It is also a remedy to be

used for malarial poisoning. Both the infantile form and the chronic variety will call for this remedy.

Nux vomica.—Indicated in cases where the patient has been doing a great deal of mental work and taking too little physical exercise; cases where there has been great loss of sleep; where the habits of life have been irregular; cases where the brain has been habitually stimulated by too much mental work, wines, brandy, whiskey, tobacco, coffee, tea, etc. The brain of a case of this kind has been hyperæmic from overwork and artificial stimulation, exhaustion follows, and the patient succumbs, a victim to cerebral anæmia. Constant aversion to physical exertion, the existence of hæmorrhoids, constipation, vesical irritation, backache, gastric disturbance, and dull frontal headache are indications for nux vomica. Especially applicable to the chronic form.

Aurum.—Cases of cerebral anæmia resulting from syphilis and the abuse of mercury. Profound melancholia, with strong suicidal tendency. I call to mind a case cured with this remedy, the patient being an old lady in whom the impulse to take her own life was almost irresistible.

Veratrum album.—Depression of the fontanels, vomiting, purging, general collapse, with cold, shrivelled, clammy skin, cold tongue, great restlessness and thirst. Applicable to the infantile variety.

Sulphur.—Useful in old chronic cases. Vertigo; indisposition to mental labor; great distress in a close, badly-ventilated apartment; the sulphur stoop in walking or standing; disposition to hæmorrhoids and constipation; early morning diarrhœa; burning of the soles of the feet, and of the vertex; tenderness of the spine, and general soreness of the scalp; these are indications for sulphur. It is also indicated in the infantile variety.

Gleanings from Foreign Journals.

ON METALLOSCOPY.

A. A paper by Dr. M. Bernhardt (Berliner Klin. Wochensch., Nov. 10, 1878).
B. A lecture by Professor C. Westphal before Berl. Medischen Geselschaft, June, 1878. Translated by M. Deschere, M.D.

About thirty years have passed since Dr. Burg observed the favorable influence of the external application of various metals on patients, the sensibility of whom had been diminished by different diseased conditions. All patients were not influenced alike by the same kind of metal; with one it was gold, with another iron, copper, or zinc to which the therapeutical success was due.

The inventor also tried the internal administration of the same metals for the same purpose, but this proved entirely unsuccessful, and the whole matter came into disrepute.

But Burg was not discouraged, and in August, 1876, he applied to the Biological Society in Paris, which application resulted in the nomination of a committee for investigation. This committee consisted of Messrs. Charcot, Luys, and Dumontpallier. The latter of these gentlemen reported the following on the 14th of April, 1877:

The first experiment was made on a girl, æt. 16, who had been a few years hysterical. Anæsthesia of the skin and muscles of the right side, the right ear almost deaf, the right eye almost blind; even very deep insertions of needles into the skin were not felt on the right side, neither did the punctures bleed. Capillary circulation was therefore evidently much diminished. Pressure upon the right ovary showed great sensitiveness. It is of course understood that the committee, experimenting under Charcot on this patient in the Salpêtrière, used all possible precaution to avoid errors. Bracelets consisting of single gold pieces were put around her right arm, as also upon the supraorbital and temporal regions. After fifteen or twenty minutes the skin on those places became

red, and the patient complained of a feeling of crawling and warmth there. Even superficial prickings with needles were now painfully felt, and bled. Hearing on that side was improved, as well as the ability of distinguishing colors with the right eye.

Similar experiments were made with other patients. The eyes were always entirely covered, and the patient was left fully ignorant of what was to be done with her. The results, which we will give here in a *résumé,* were essentially the following:

Besides the return of sensibility to the places which had been covered with the metal for a certain time, a "*dysæsthesia*" appeared in the surrounding parts; *f. i.*, a patient who had a cloth applied, which had been dipped in boiling water, complained of intense coldness of the respective part, and *vice versa.*

If experiment had proved gold to produce the effect in one patient, zinc, copper, or iron would prove to be inert in that case, while with others just one of the latter metals was alone effective.

Also the muscular power increased on the weak side in proportion as the formerly healthy side lost, which was indicated by the dynamometer.

An increase of heat was also observed by the thermometer. The temperature being at first 2.5° C. lower, was afterwards 1.7° higher than on the healthy side. After two and a half to three hours the same conditions as before the experiment returned. The patients were weak, sleepy, and complained of headache.

Dr. Gellé was the first one to observe the *loss of sensibility of the healthy side* in the same ratio as the affected side gained, and he convinced the committee of this fact by his examinations of the sense of hearing. The same was observed by Landolt, with reference to the sense of vision, and by the committee itself in regard to the sensibility of the skin. Absolutely the very symmetrical spots on the healthy side diminished in the same degree as the feeble one increased. It was an actual *transfer.*

The most interesting point found by the committee was,

that not only hysterical persons were thus influenced, but also those with organic affections of the brain, suffering with hemi-anæsthesia.

Mrs. R., fifty-four years old, suffered for many years with right-sided hemianæsthesia, hemichorea, and hemiplegia after a brain affection. Gold, copper, and zinc were useless; only iron reinstated the sensibility after an application of twenty minutes; at first on the points of application, but after a few days on the entire right side. At the same time the choreic movements were much reduced. Placing small iron plates on the right side of the tongue and nose, the taste and smell returned. Similar results were obtained in other brain affections. But it is most remarkable that the good effect is not transient as in hysterical patients, *but permanent in organic troubles.*

Charcot's idea that the effect produced was due to weak electric currents, induced by the contact of the metal with the human body, was then investigated, with the assistance of Dr. Régnard (Professor Bert's assistant).

A very sensitive galvanometer showed the actual existence of weak currents during the application of gold, of a strength of from three to twelve degrees. If, now, a person susceptible to gold was brought into contact with a galvanic current of the same strength as the gold produced, *f. i.*, two degrees, the same result would take place as if the gold had been applied; the skin became red and warm on the points of contact; it began to bleed from former needle-introductions; it became sensitive; in fact, showed the entire phenomenon as with the gold application.

The same patient, being indifferent to copper, applied copper plates produced a current of fifteen degrees on the galvanometer, that is a stronger one than gold had produced. If, then, a galvanic current of fifteen degress was substituted for the copper, the patient remained just as indifferent to this stronger current as she had been to the copper before.

Therefore, after knowing the "metallic idiosyncrasy" (if we may call it so) of a patient, a galvanic current of the same

strength as the one produced by the metal, according to the indication of the galvanometer, may be substituted.

These facts gained interest by a new discovery. After finding a patient to react to currents of 35°–40° (galvanometer), the strength of the current was increased to 50°–70°. But these stronger currents were found to be ineffective, the action commencing again, by elevating the strength to 90°. This shows that there are points in the galvanometric scale which have an identical influence on the patient, while this was not present above or below these points. Régnard called these points "*neutral.*" But the most interesting phenomenon was that of the "*transfert de la sensibilité,*" which we shall review once more.

The committee found in many repeated experiments that restoring the sensibility in the affected side by means of a metal or the electric current, this restoration took place at the expense of the sensibility of the healthy side. If the arm or leg had become sensitive on the anæsthetic side, the healthy side had lost this power on the identically opposite points. If the test was extended over the whole side of the body, by applying a current from head to foot, the healthy side would grow anæsthetic in the same proportion and succession of order. In the very same manner the healthy organs of special senses diminished in power as the weak ones gained. Finally we have to state that after a prolonged application of the metals the restored sensibility and muscular power may gradually decrease or entirely disappear again (anesthésie et amyosthénie de retour).

Charcot in a recent letter gives his own opinion of the matter in about the following words:

"The influence of applications of metals over the phenomena of anæsthesia with hysterical persons exists beyond doubt. The point here is especially '*Metalloscopy,*' not '*Metallotherapy,*' for the therapeutic effect is rather a problematic one up to date. But, notwithstanding, I must admit that in four cases of severe inveterate hysteria, which I selected, the experiments of Burg produced decided improvement in three cases, while one has

to be regarded entirely cured. But, nevertheless, I believe we must wait yet before we pass an opinion on the therapeutic part of Burg's theory. To the question, if the action of the application of metals be only effective with hysterical patients, I can answer that in a case of total hemianæsthesia from organic causes, the application of metals restored the sensibility entirely and permanently, to my great astonishment. Since then I observed a quite similar case of cerebral hemianæsthesia which was affected in the same manner by metal applications. In both these cases of, I repeat it, cerebral anæsthesia, due to organic lesions, the results were permanent and lasting for over a year since the experiment. In contradistinction to these, the anæsthesia returned in cases of hysteria in from one-half to at most twenty-four hours in the same degree as it existed before. It seems that this *transitory character* in the phenomenon is a distinguishing feature between *hysterical anæsthesia* and affections to be traced to *organic cerebral lesions.*

"I have tried the application of metals in various cases belonging to the class of *spinal anæsthesia* from organic causes (myelitis, ataxia, etc.), *without getting the least result.*

"That is, in short, all what I have to say about metalloscopy. I have varied the experiments lately, and am convinced that we have here a very interesting subject for study. Perhaps we may find in these studies material to build a theory on; but until now, we were dealing with quite strange, peculiar, unexpected facts, the objective truth of which cannot be doubted. Burg, in his enthusiasm, naturally goes further than quiet observation so far allows; but I am firmly convinced that he has rendered an actual service to science by his fine and ingenious observations, as he opened a new path for fruitful investigation."

B.

GENTLEMEN: You have undoubtedly taken notice of the remarkable fact, which has been reported from France within a year, that anæsthetic portions of the skin become sensible again by the simple application of metallic plates. Such an

appliance of metal plates seems to have been used as a domestic remedy in different countries for different healing purposes. But the facts to which we will refer presently relate more particularly to observations which have been made in the years 1848–'49 by the French physician, Dr. Burg, and further in several French hospitals, in the *Hôpital Cochin*, in the departments of *Maisonneuve* and *Nonat*, afterwards in the *Salpêtrière*, in the department of *Lélut*, etc. But Burg does not seem to have been well appreciated at that time, at least nothing was heard of it until, in August, 1876, he made the motion in the Société de Biologie of appointing a committee for the investigation of the facts related by him. This committee was really appointed, consisting of the Messrs. Charcot, Luys, and Dumontpallier; the latter gentleman reported in the meeting of the Société de Biologie on April 14th, 1877.

Burg had made the following statements:

1. The return of sensibility of the skin in anæsthesia can be obtained by the application of metals.

2. Every patient has a special idiosyncrasy, *i. e.*, an invidual disposition to be influenced by one metal or another.

3. This condition of sensibility stands in relation to a general condition in a way that the metal which restores the sensibility of a patient also has a healing influence on his general condition when taken internally.

Even before the committee had commenced its investigations Mons. Charcot had made experiments, the results of which seemed to confirm Burg's statements.

But in Germany, as well as in England, these facts were received with the greatest mistrust, in which I joined the more, as several experiments with hysterical persons had only given negative results; but I must here remark that they had not been conducted quite systematically.

In the meantime the news from Paris had spread; the committee made its report in April, 1877, in the views of Burg, with additions of newly-found facts; and it seemed, indeed, no more advisable to keep simply opposing them.

Under these circumstances I considered it my duty to take

notice of the asserted facts at the right place, and for this reason I went to Paris last April. Mons. Charcot had the kindness to demonstrate to me those patients who showed the phenomena in question. But before I report to you what I have seen there, about the results of the committee and about my own experiments after my return, I may be permitted to present to you a few patients who show the kind of affection with which, with some exceptions, the French experiments were made. They were hysterical females, with hemianæsthesia, which originated either after an hysterical attack or spontaneously, in which the organs of the special senses participated, so that the acuteness of seeing, hearing, tasting, and smelling were either much lessened or entirely absent. You see here a patient whose skin is anæsthetic on the entire left side. I prick her with needles deeply into her finger tips and into the skin between the fingers; I perforate the alæ nasi, the lips, etc., without the patient knowing that anything has been done to her at all. You see that the hemianæsthesia is cut off in the median line. Only one point shows sensitiveness; when I touch a small place behind her ear the patient each time shrinks from the pain. This is the more remarkable, as with another patient who never saw this one the same spot is found sensitive, while the entire left side proves anæsthetic otherwise.

The patient which I here present to you also shows entire loss of muscular power on the left side, which may be nicely demonstrated. I elevate her left arm, which remains for a time in that position; I now let the patient grasp her left hand with her right one. You see how she feels for it at the place where it had been before elevating it, and how she is looking for it, as she cannot find it in the old spot. She has, therefore, no conception of the change which her left arm had undergone. This patient also shows a great deficiency in the distinction between colors. But I cannot demonstrate this weakness of the organ of vision at present, as she recovered from it by the application of metal plates a few days ago, and only to-day she begins to lose her power again.

Another point of interest may be demonstrated on this patient. Mons. Charcot has made the observation, as you know, that a pressure upon a certain point of the abdomen on the anæsthetic side is very painful. He supports the view that it is a pressure upon the ovary which produces the pain. The condition of our patient corresponds to this: I press upon that spot on the left side, and the patient shows all the expressions of the most acute pain, and she can but slowly recover from it. A simultaneous sensation, like an aura to the neck and head is not perceived by her; at the *right* side the same pressure is entirely ineffective.

Such hysterical hemianæsthetic patients are the ones with whom experiments with metallic plates have been made, and on which they have been demonstrated to me. I really saw that if a metal plate had been applied for ten, fifteen, at the most twenty minutes, the respective point, and generally a smaller or greater surrounding circle became sensitive. In some cases the entire anæsthetic side became restored in a radiating manner from this place. With several patients suffering from color-blindness this was cured by applying plates at the respective points on the forehead and temples. The same effect was caused by magnets. The poles of a strong horseshoe magnet were applied to the anæsthetic parts of the skin; after some time the sensibility of those places had returned. The application of the round part of the magnet where it is bent was of no effect. The anæsthetic hand of a patient was placed between the poles of a strong electro-magnet without touching them; sensibility was restored after fifteen to twenty minutes.

Mons. Regnard, who had also assisted the committee, made the following experiment in my presence: A galvanic element was connected to a Wagner's hammer by a single coil of a finger's length, so that an interrupted current passed through the coil. Into this coil the patient introduced one of her anæsthetic fingers; after a short time the finger had become sensitive.

With all these experiments the form, the committee so-

called, "transfert de la sensibilité," appeared; that is, the corresponding places of the healthy side became anæsthetic in the proportion as the affected side recovered.

At last I mention another experiment made by Mons. Regnard. If a healthy person looks upon a rotating plate composed of red and white sections he will see pink, and so will the hemianæsthetic patient, if she looks with her color-blind eye into the rotary plate. If the sections are green and red, a healthy person will, on rotating the plate, see a dirty white. The patient could not see green with the affected eye; nevertheless, she also observed the rotating plate to appear white, as if she had perceived the red with the green!

These are the principal facts which were presented to me.

After my return from Paris, I undertook some experiments in my clinic, with the aid of my assistants. The patients were selected partly from the department of nervous diseases, partly from spasmodic affections. You will permit me to report briefly a few of these experiments: A hysterical patient, Beyer, twenty-six years of age, suffers from left-sided anæsthesia of the skin, amblyopia, color-blindness, difficulty of hearing, loss of smell and of taste, all on the left side; also loss of muscular sense on that side. On the 24th of April, two zweimarkstücke (silver pieces of the size of a quarter of a dollar—M.D.), were applied to the left forearm. At 1 P.M., no result. At 2.30 P.M., a sensation of crawling and titillation in the skin above the left knee. Patient pricks her arm with a pin, and observes "with horror" that she feels it. At an examination at 4.30 P.M., the whole left side of the body appears just as sensitive to touch and pricking as the right one; also the nature of things which were placed in her hand was correctly perceived (whether glass, wood, metal, etc.); also the muscular power was restored, as well as acuteness of the organs of special senses. The phenomenon of "transfert" could not be stated at the time of the examination (perhaps it was present and disappeared again).

On April 29th, at 6 P.M., the silver pieces were placed again upon the left forearm. (Anæsthesia had reappeared after four

days.) At 6.25 P.M., the patient perceived intense crawling in the palm of the left hand; on examination the entire left side of the body appeared sensitive, *but the right forearm and hand had become anæsthetic;* likewise the right half of the face and head, limited by a line, which runs behind the ear down below the inferior maxillary, where hyperæsthesia exists as well as on the right upper arm. After five days the anæsthesia of the right side had disappeared again, so that sensibility was present all over the body. But another hysterical attack brought on the old condition, left-sided anæsthesia.

A patient, twenty-two years of age, not hysterical, kept a right-sided anæsthesia after an attempt at suicide by a large dose of chloral hydrate. When I saw the patient, sensitiveness had partially returned, but an insensibility was present in the region of the ulnar nerve. Touch and light prickings were not perceived, while deep punctures were felt, but with diminished acuteness.

May 18th, 10.30 A.M., applications of silver coins, fastened by a ribbon above inferior extremity of ulna. At 1.45 P.M., after uncertain drawing sensations in the hand, a return of sensation was perceived. 5.30 P.M., subjective symptoms of "drawing, crawling, and burning" in the whole hand. After removing the ribbon with the coins, also the little finger and the ulnar had become sensitive to slight touch. The ribbon is reapplied; but in spite of this the sensibility was less the next morning, and by 3 P.M. the little finger had again become partly anæsthetic. Analogous experiments with the same patient constantly gave negative results.

With another patient, Sparr, suffering from left-sided anæsthesia, sensibility was restored upon the whole left side after an application of gold to the left forearm for five hours. Patient had experienced a sense of crawling in the arms before the return of sensibility. The latter lasted for three hours. After a second trial the sensibility remained until the following morning, while the plates had remained *in situ.*

An application of iron with the same patient had the same effect. This showed that the same result may be obtained with two different metals.

Hinze, twenty-five years old, hysterical since her confinement. Anæsthesia of the entire left side (with exception of the organs of special senses), and partially of the right side. Ovarian hyperæsthesia on the right side. April 27th, 5.30 P.M., a little galvanic element, consisting of a small plate of zinc and one of brass, combined by a moist strip of linen, were applied to the left forearm, the zinc below.

April 28th, 5 A.M., feels an itching at the points of application.

9.15 P.M., return of sensibility at the close surroundings of the plates.

The next day, 11 A.M., the places were only sensitive to deep stitches.

June 3d, 11.50 A.M., a strong *stone magnet* was applied to the left forearm of the same patient; the south pole of the magnet directed to the periphery of the extremity. At 12 M., the skin appears sensitive to needles towards the south pole. 12.20 P.M., also at the north pole. 12.30, also at interpolar space; but a slight touch is not felt. In all other parts of the arm perfect anæsthesia. 1 P.M., patient reports a sensation of crawling and titillation in the forearm reaching to the finger-tips. 1.05 P.M., also slight touch is felt in the surroundings of the poles, and at the interpolar space. At 4 P.M., only the lower two-thirds of interpolar space are sensitive to slight prickings. At 6 P.M., only deep stitches are felt at the south pole. At 9 P.M., all sensibility was lost again.

The experiment was repeated with the patient, the positions of the poles changed, but the sensibility always returned at first near the south pole and disappeared there the latest.

On May 12th, copper-plates had been applied to the patient Sparr, which were *varnished* on the side of contact with the skin. In the evening no change. The next morning at eight, the plates having remained *in situ* all that time, return of sensibility in the whole left side.

May 31st, application of copper-plates, covered with *sealing wax* on the side of contact, to the same patient. A gauze bandage is fastened very tightly around the plates and arm, so that the hand swells and becomes slightly cyanotic. No return

of sensibility in the evening. Next morning intense painfulness of the forearm in the very œdematous hand. On testing, return of sensibility is manifest in the entire left side, with exception of the upper arm, at the point where the pressure of the bandage was greatest, and at the spine of the scapula. At the right (healthy) arm punctures are said to be more painful than before. Three hours after having removed the plates and bandages, the face and head had again lost their sensibility, only the mucous membrane of the nose is still sensitive, while sensibility had spread on the upper arm and shoulder. About the forearm the statements vary. At the corresponding places of the right arm, *anæsthesia* became pronounced where the plates had been on the left. (Transfert appearing late.)

May 22d, 10 A.M.; the same patient; application of *little flat bone plates* to the left anæsthetic arm, fastened down tightly by a gauze bandage.

2.30 P.M., pain under the pressing plates; examination reveals return of sensibility at the spots where the plates and bandage had pressed; the other parts had remained anæsthetic.

Bandage and plates were then left *in situ* all night. Next forenoon sensibility spread over entire forearm and hand. The presence of sensibility seemed to depend on the grade of pressure employed. The hand is reddened, slightly swollen, and perspires much. In the afternoon sensibility is spread over the entire left side with exception of the head, of which only forehead, cheek, and mucous membrane are sensitive.

During my absence in Paris, my assistant, Dr. Adamkiviecz, made experiments with *mustard plasters* at the anæsthetic parts. Hysterical patient Hinze, who has been mentioned before, suffering from total anæsthesia of the entire left half of the body, forearm, and leg on right side, had a *mustard plaster* applied to the left forearm. After this had remained in position for about two hours, the skin appeared sensitive to stitches, touch, etc., in the parts which were reddened by the plaster. Many experiments following this first one had always the same result, so that quite a number of sensitive spots could be produced where patient was able to distinguish any irritation with her

eyes closed; while in the close surroundings of those places anæsthesia was as complete as ever.

The sensibility remained long after the irritation of the skin had disappeared, and lasted six to seven days.

Also "transfert" was demonstrated in another patient by the application of mustard plaster.

In closing I would remark that with all these patients an irritation of the skin with the electric brush remained ineffective.

To the communication of these facts I may be permitted to add the following general remarks: At first I should like to oppose the far-spread belief that the phenomenon of hemianæsthesia in hysterical patients depended simply on fraud. This is entirely out of the question in these cases. To prove this I mention that patients remained entirely undisturbed during sleep at night, when even deep stitches were made into the anæsthetic side, while they at once awoke when so treated on the healthy side. A number of patients did not even know, before the examination, that they were anæsthetic in any part of their body; as was the case with the patient Hess, whose anæsthesia was discovered accidentally, to her own surprise, soon after her reception in the hospital. Finally, does the peculiar division of the anæsthesia not speak in favor of imagination?

We must, therefore, even if against our will, *acknowledge* those facts, which have been observed in Paris and Berlin, in the most identical manner, with different persons under different circumstances. Whether similar observations have been made in England is unknown to me; but I have reason to doubt it, as Dr. Althaus lately wrote to me from London that cases of hemianæsthesia were not seen there, hysterical anæsthesia of any form being very rare there. Perhaps cases will appear there more frequently after the attention having been drawn to them.

By our experiments the facts observed in France have been confirmed as a whole. The time in which sensibility returned after the application of metal plates was in some cases much greater than it had been noticed in Paris. But it was observed

(against Burg's theory) that *several* metals might influence the same patient (I have not reported all respective experiments); that the same effect can be produced by *varnished* plates, as well as by such covered with *sealing wax*, and by *non-metallic* plates; but that here the result appears more slowly, and seems to be influenced by the pressure employed. The same phenomena may also be produced by the application of mustard plasters.

The theory of Mons. Regnard, of electric influence produced by application of metal to the skin, is somewhat shaken by our experiments; at any rate galvanic currents cannot be regarded as the *only* factor, or it must be testified that galvanic currents also originate by the other tried applications. Perhaps there are *different* irritants that have to be regarded here, certainly not all of them, as the negative results show on immersing the anæsthetic parts in hot water, or by the treatment with the electric brush.

The spreading of sensibility from the locally treated spot all over the affected side, as well as the "transfert," remain inexplicable. Numerous other experiments are necessary before we may utter an opinion on these points, much less to build a theory on them.

It lies near enough to fall back in all these questions to the domain of *conception*, the power of which is well known regarding production, as well as non-perception of sensations.

Regarding the therapeutic value of metalloscopy, the related facts show that in the application of metallic plates the return of sensibility is limited to the points of application, and is only a temporary one; but in some cases sensibility of the entire anæsthetic half of the body was restored more permanently by a single application. Of course a new hysterical attack would make anæsthesia return as before.

In the related case of the patient Hess, sensibility remained permanent after a single application of a mustard plaster. I saw the patient again after several months, and could not find a trace of anæsthesia; at the same time all her other hysterical symptoms were much improved. Should the peculiar fact be confirmed, in which the internal administration of the metal

which cured the anæsthesia acts beneficially upon the whole hysterical condition, metalloscopy would really gain such importance in therapeutics as the inventor claims for it. Observations to this point have been lately published at the Salpêtrière.

ARTICLE II.

INFLUENCE OF SOLENOIDS ON THE NERVOUS SYSTEM.

BY GEORGE SIGERSON, M.D., CH.M., F.L.S., MEMBER OF THE ROYAL IRISH ACADEMY, OF THE SCIENTIFIC SOCIETY OF BRUSSELS, AND OF THE CLINICAL AND ANTHROPOLOGICAL SOCIETIES OF PARIS.

(From the British Medical Journal, April 26th, 1879.)

IN a recent contribution to the study of certain phenomena connected with hystero-epilepsy and cerebral anæsthesia, I proceeded (after showing that their appearance depended, in given cases, on physical causes) to indicate what might be the efficient agents. The conclusion arrived at from an analysis of the various experiments was that, generically speaking, a peripheral stimulus was required, which, by affecting the superficial nerve fibres, should by that medium react upon the nerve centres. Several kinds of stimuli have proved effectual, such as the galvanic and faradic currents, the influence of solenoids and magnets at a distance. The application of metal discs, having been found to give rise to feeble but effectual currents, came under the same head. The generic term was adopted in order to include stimuli other than electrical, such as, for instance, the irritation of a sinapism, a ligature, or (possibly) the actual cautery.

On the other hand I ventured to point out that, before excluding the possibility of physical agency in cases where apparently inefficient objects were successfully applied, it was desirable to investigate whether some unnoticed cause had not been at work to disturb the electrical condition of the part. Thermo-electric currents, for instance, might be produced by inequalities of temperature not generally suspected of possessing such an influence; and other readily overlooked agencies

might give rise to electro-motive action sufficient to furnish the physical stimulus required.

If I refer to this subject at present, it is because recent researches have come to corroborate these propositions, and to extend our knowledge of a question which is both interesting and important whether we consider it from a pathological or physiological standing ground. Obviously, however clear the deductions drawn from experiments on the human patient might be, it still remained desirable that these should be verified and controlled by investigations on animals in the physiological laboratory; above all when the agency of expectant attention had been so much insisted on. Since his experiments at La Salpêtrière, which I have described, Professor Schiff has devoted his attention to this point. Having first made certain that the alleged phenomena were real, he reasoned that, as it was impossible to suppose the existence of special laws for hysterical cases, the phenomena in question must be the expression of a general property of the animal machine, which becomes visible when the nature of the disease produces or fosters a great excitability of the nervous system. Moved by such considerations, Professor Schiff undertook a series of experiments which have given some remarkable results. They were conducted chiefly with a view to determine what influence, if any, was possessed by solenoids and magnets; but some observations were also made with respect to the influence of metallic discs. The results may be briefly summarized as follows:

Metallic Discs.—It has been already indicated, in these columns, that Dr. Vierordt, of Tübingen, found that, on the application of a metallic disc to the abdomen of the frog, reflex sensibility became augmented in the posterior extremities.

Professor Schiff states that he has been a witness to the fact that when metallic discs, from one and a half to two centimeters in length, were applied to the posterior extremities after destruction of the nerve centres, electric currents of some energy resulted. The principal current passed through the metal, and the derived currents through the animal membrane. Hence they could provoke in miniature all the effects known to flow from what has been called electrotonus of nerves; in

other words, they could, according to their direction, augment or diminish, or generally modify, nervous excitability. In the case of the human subject, the application of metallic discs to the surface of the hands gives derived currents in the galvanometer which are much weaker than those of the frog. Their intensity may be modified by the nature of the metal, the moist condition and difference of temperature presented by different parts of the skin to which the application is made. It is regarded as possible that the unequal pressure of different parts of the disc upon the skin may give rise to currents.

Professor Schiff had supposed at first, with others, that the metallic discs became active, because currents were developed by contact with the different secretions of the skin. In order to test whether this were so, he interposed between an amalgamated zinc disc and the skin a layer of blotting-paper, kept moist with a concentrated solution of Sulphate of zinc. Notwithstanding this, the usual phenomena took place. Hence he concludes that it is scarcely probable that chemical differences produce the currents; and after these experiments he prefers to suppose the existence of a thermo-electric current, such as I have suggested.

In the experiments on animals, the extremity, when placed within the cavity of the solenoid, was carefully isolated by the interposition of a glass cylinder, or wood covered with wax, in the case of frogs. When the extremities of mammals (dogs) were made use of, it was found that the body of the concentric bobbin and the hair of the animal sufficed to secure isolation. Sometimes, in the case of frogs, the pole of a strong magnet, or electro-magnet, was employed instead of the bobbin, and placed at a distance of four millimeters from the nerve or extremity. The experiments are divisible into two series: (1) those which relate to the peripheral nerves, and (2) those which concern the nerve centres.

1. *Peripheral Experiments.*—In the first series of investigations, frogs only were made use of. An extremity was taken, or else the whole frog, with the exception of the brain and upper part of its spinal marrow, which had been removed. The results were negative. It is to be remarked that in Dr. Vier-

ordt's experiments, the upper portion of the spinal cord was not removed, though the cerebral lobes were taken away. Prof. Schiff is far from considering that the negative results of these experiments prove the nullity of the agencies in question; on the contrary, he hopes, by improving his methods of research, to obtain positive results.

Here it is necessary to point out that these negative results do not at all affect the authenticity of the phenomena observed in the human subject. In such a case the hemianæsthesia is complete; in other words, one entire half of the organism is affected, externally, at least, by insensibility. Hence it is imperative on us to conclude that the intracranial nerve masses are involved in some way, and therefore, between a patient thus affected and an animal from which the brain and upper part of the spinal cord have been removed, the conditions are not analogous.

2. *Central Experiments.*—As subjects for the second series of researches, live dogs were chosen. It should be premised that Prof. Schiff found, in 1871, that those parts of the brain which MM. Hitzig and Fritsch regarded as motor centres, have no direct influence on motion, but are really centres of tactual sensibility for various portions of the body. No motor paralysis results from their destruction, but tactual sensibility is abolished, and with it the sense of position as regards the extremities affected. The movements which irritation of those portions of the cortex produces, are to be considered as movements due to reflex sensibility, and the disorderly state of some movements after extirpation of the aforesaid parts, should be looked upon as the result of the absence of tactual sensibility, the organ of which has been abolished. Faithful to the principles of the experimental school, Prof. Schiff, whilst rejecting the doctrine of the existence of motor centres in animals, admits their presence in man, because clinical observation, and especially the important investigations of Prof. Charcot, appear to have demonstrated their existence beyond all question. For some time he was disposed to admit, after Prof. Ferrier's experiments, that such centres probably existed in monkeys;

but he considers that the experiments of Luciani and Tamburini (notwithstanding their personal inferences) tend to prove the contrary. Most physiologists, especially in Germany, he adds, have rallied to this opinion. Even Prof. Hitzig admits that, in those centres, which he still calls "motor," he recognizes centres of the sense of muscular attitude. Lastly, Prof. Schiff's opinion has been completely confirmed by the fine experiments of Dr. Munk. According to the investigation of Drs. Goltz and Munk, if the lesion (at first affecting the cortex and producing tactual insensibility) be carried deeper into the white substance, sensibility to pressure and sensibility to pain will become affected. It follows from the foregoing that, according to the depth of cerebral lesion made, we can abolish tactual sensibility alone, or simultaneously diminish sensibility to pressure (and to pain). Such changes can be made to affect the hinder or fore extremity, or the face, at the side opposed to the lesion, by following the indications given by MM. Hitzig and Fritsch for the destruction of the so-called "motor," that is, the sensory centres of these organs. Prof. Schiff holds, with Prof. Hitzig, that there is no restoration of function possible in a centre which has been really destroyed. Apparent restoration occurs only where the destruction has been imperfect, or where the function has been temporarily abolished through the influence of an injury to a part in the vicinity.

Making use of the means indicated, anæsthesia of cerebral origin was produced in several dogs, and allowed to affect them to a greater or less extent. Some months were then permitted to elapse in order that all transitory effect of the wound should have disappeared, after which experiments with the magnetizing bobbin (to use Ampère's expression) were begun. The animal having been placed on a table in the attitude of repose, the forelimb (when that was experimented on) was passed through the cavity of the solenoid, which thus included the lower part of the humerus, whilst the protruding paw was free, in order that the state of sensibility might be determined by irritating it. The mode of irritation adopted was of the mildest, consisting as it did of lightly stroking the hair with the finger-tips, avoiding pressure with the nail.

Repeated tests showed that the anæsthesia remained unaltered whilst the animal was in this position, so long as the circuit was open. The effect of completing the circuit may best be understood by a short description of an experiment. A long-haired spaniel, which had been operated on some time before, had to all appearance completely recovered his normal condition, with the exception that in walking over rough ground, or going up-stairs, he frequently leaned his weight on the dorsal part of his toes, which Professor Schiff regards as an infallible sign of tactual insensibility. The presence of anæsthesia was carefully determined by other tests. When the animal was placed in position as described, if the dorsal hairs of the left (*i. e.*, the sound) paw were slightly stirred by a quick downward touch, the paw was at once withdrawn, a thrill passed through the body, the hinder legs were momentarily extended, and that which was uppermost, or free, was kicked out. The muscles of the neck stiffened. The effect, like the irritation, was momentary. When the palmar surface was lightly and quickly touched the result was less general, but the paw was drawn back, and the hinder leg kicked out. When the right (or anæsthetic) limb was irritated in the same manner, there was no movement whatever, neither in the paw nor elsewhere. Neither was there any movement when the hand was lightly closed and drawn over the included paw, though this had caused movement in the left limb and left side. The circuit was closed. Five minutes afterward, when the last-mentioned test was repeated, there resulted movements of extension and flexion of the articulation of the foot, and occasionally the toes spread out. Twenty minutes later the excitability was found to have increased, for if the palmar surface of the paw was tickled by stirring the hairs, the foot was flexed; extension and flexion after contact had become more marked. The left extremity retained its sensibility. The acquired sensibility persisted during four or five hours, and even longer; when it disappeared it could be reproduced in the same manner, sometimes in the course of the same day, but, generally speaking, on the following day. The result was subject to some modifi-

cation when the experiment was performed on dogs of different temperaments; for instance, in the case of a large dog, of less sensibility than the spaniel, recovery of tactual sensibility was only shown after pressure on the interdigital web, but here the posterior extremity showed signs of recovery as well, though the fore limb alone had been placed within the solenoid. It is, however, unnecessary to enter into the details of the several experiments. The essential point is that in all of them recovery of tactual sensibility in the anæsthetic region was detected. In some animals there was less recovery, in others more; but in every one of the cases the anæsthesia gave way before the influence of the solenoid, in the cavity of which an isolated member was placed. These remarkable results, therefore, supply ample evidence of the correctness of my conclusions, and distinctly corroborate the report of Professor Charcot's commission at La Salpêtrière.

Article III.

BEHIND THE TIMES.

"Strumous Cervical Abscess Treated with the Galvano-cautery." *From Medical and Surgical Reports of Guy's Hospital* (under care of Mr. Bryant).—Alice G., aged fourteen years, was admitted April 1, 1879. There were no points of interest in her family history. About twelve months ago she first noticed a swelling on the right side, just below the angle of the jaw. She was then under medical treatment, and after a time had the swelling lanced. The wound discharged for some time and then closed. About a week before admission the wound reopened and again began to discharge. When admitted, patient was a somewhat strumous-looking but healthy girl. Just beneath the angle of the lower jaw on the right side was a cicatrix of an old wound, and an enlargement, apparently glandular. The skin over it was reddened. Under the chin there was a similar swelling about the size of a walnut. This commenced about two weeks pre-

vious to admission. There were no bad teeth, nor could any other obvious cause of irritation be found. In other respects patient's condition was good. Menstruation had not commenced.

April 12. To-day Mr. Golding-Bird treated the swelling on the side of the face by his method of galvano-puncture. The apparatus used consisted of an oval plate of silver, about three inches in its long diameter, two inches in its short; with the centre of this was connected a copper wire, to which was attached a piece of zinc, shaped like the blade of a dagger, for insertion into the gland. The zinc passed through an oval plate of vulcanized india-rubber, which was used to keep it in position. A piece of lint kept soaked with salt water, and placed on the chest, received the silver plate, and the gland having been punctured with a lancet, received the zinc terminal.

16th. The apparatus has been kept applied until this afternoon. Patient has once or twice complained of pain in the gland, but has been easier to-day. A linseed poultice has been applied.

19th. On removing the poultice last night the destroyed glandular mass came away with it, and left a tolerably clean surface discharging a little pus.

21st. A shallow, healthy wound remains, which is being dressed with a carbolic solution.—*Medical Times and Gazette, May* 3, 1879.

[Where the *galvano-cautery* comes in, we are unable to discover. We presume that this case is reported to put before the profession a new and superior mode of treatment for such conditions.

The slough, of course, was caused by the escharotic action of the chloride of zinc. The chloride of zinc was produced by the chemical union of the metallic zinc dagger with the chlorides of the tissue into which it was inserted. That the action on the zinc was caused by making it the positive plate of a galvanic cell we do not deny. Nor do we undertake to deny

that Dr. Golding-Bird was the inventor of this method of treatment; but if he was, it must have been several years ago, as this treatment of strumous abscesses was used in this country at least four years ago, and since abandoned in favor of more exact methods. The operation has nothing to do with galvano-cautery, but is a rough mode of using secondary electrolysis. The objection to the operation is this, that we have no means of calculating at what rate the chloride of zinc is manufactured, as we cannot conveniently measure the resistance of the circuit, which is ever varying, from evident causes. It is much better to use a battery with both terminals inserted into the tissue, as thereby we can calculate more exactly the amount of tissue destroyed, and so control the size of the slough to certain limits.—ED.]

ELECTRICAL TREATMENT OF CONVULSIVE TIC AND CHOREA MINOR, BY PROFESSOR BERGER (BRESLAU). Translated by *S. Lilienthal, M.D.*—The treatment of idiopathic convulsive tic, especially where heredity plays its part and where the spasm has existed some time, is nearly always unsuccessful. Drug treatment as well as electrotherapeutics have failed in many otherwise successful hands. Considering it possible that in some cases of convulsive tic and chorea minor a state of irritation of the corresponding centres inside of the motor zone of the cerebral cortex may be the cause of it, I apply the anode in the form of a large plate on the vertex (after parting the hair and moistening the scalp), whereas the cathode is held in the hand or fixed on the back. Thus a stabile current of moderate strength used for five or ten minutes uninterruptedly in order to prevent irritation. In semilateral twitchings only the opposite side of the vertex is armed with the anode; where both sides are affected, a bifurcated electrode is used, one terminal being placed on each side of the vertex. As in partial (semilateral) epilepsy the presumption of a cortical lesion may be surmised, the same treatment may be recommended.—*Centralblatt der Nervenheilkunde*, May 15th, 1879.

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Editorial.

LESS than twenty years ago, a period within the recollection of the majority of the physicians of to-day, the use of electricity in any form as a therapeutic agent was scouted and derided as quackery; and up to a still more recent period those manifesting any interest in electrology were looked upon with suspicion, and if not actually branded as charlatans, were at least sneered at and avoided by the large majority of physicians.

To-day all this is changed, and electricity is now honorably enrolled among our list of therapeutic agents, and admitted to be one of the most potent weapons we possess in combating many forms of disease. As a means of diagnosis, the induction machine and galvanic battery stand side by side with the stethoscope, plessimeter, dynamometer, sphygmograph, etc., while their uses in surgery in the treatment of tumors, strictures, and other diseases, in which resort to the knife is inadmissible or undesirable, need not be more than alluded to. Within a few years, electro-therapy has made very rapid progress—so rapid, indeed, that works on the subject written but a short time ago are now almost valueless as textbooks, containing none of the recent developments. But although the knowledge of the uses of electricity in medicine and surgery has advanced rapidly, it has not kept pace with the progress of electricity in other branches of science. In electro-surgery this is particularly evident. In the books that have been written, although the principles that govern the physiological, chemical, dynam-

ical, and other actions of electricity are admirably given in outline, making these works very useful to the student and practitioner in acquiring a general knowledge of the subject, still the attention of the reader has not in any of them been drawn to the absolute necessity of attaining precision in operating, precision in the administration of the required dose and no more, precision carrying out the thousands of little details which tend to make electro-therapy a certain science. So that these works are of but little value to the specialist. The consequence of too much generalization in our literature has been a looseness in operating, inattention to details, neglect of the laws which govern electricity (the knowledge of which gives the only key to success), and has led to much blind and ignorant experimenting, which is to be deplored.

Every electroplater can calculate to the utmost exactness, just how much silver or gold or nickel or other metal he deposits on an article to be plated, in a minute, or in an hour.

Those engaged in the construction of telegraph lines, know exactly the amount of current to use on a line of a given distance.

Experts in electric lights will tell you without a moment's hesitation the precise expenditure of force necessary to obtain a light of a certain power of illumination.

But practitioners of electro-surgery—how many of them can tell how much current to use on a given case? How many can give even a proximate estimate of the amount of actual current it will take to coagulate the necessary amount of blood to cure an aneurism, will exert sufficient chemical action to produce total destruction of a malignant growth, or will cause enough interference with the nutrition of any tumor to cause its speedy disappearance either by absorption or suppuration, at the option of the operator? Very, very few. And why should this be so? Do not the same natural laws govern the action of electricity in every case? Certainly. The amount of work done is always proportional to the amount of actual current flowing through the circuit in a given time, and the amount of actual current always equals the electro-motive force divided by the sum of the resistances. This law of Ohm's is recognized by the electroplater, by those skilled in telegraphy, and by

those engaged in electric lighting. That they must adapt their work to it is evident; for if they do not, and use too little force, the work is not done; if too much, it is overdone, and the expense is added to enormously.

With amateurs in electro-surgery it is different. If in a case of tumor or stricture, too little current be used and no improvement follow, it is put down as another unsuccessful case, or else nothing is said about it. If too much be used, and the patient die, or be disfigured from destruction of the surrounding healthy tissues—well, it could not be helped, everything was done that could be done under the circumstances, and so electricity earns a bad reputation. If the doctor happens to use just enough current, and a cure results, the fact is heralded as another glorious achievement in electro-surgery, paraded at society meetings, and copied from one medical journal into another. This state of things should not exist. We can and should do better; we have most, and can obtain *all* the data necessary for absolute precision, and our electrolytic operations *can* be conducted with the utmost exactness if we only pay attention to these data.

To illustrate our meaning let us suppose a case—say of aneurism. Now, in order to cure this aneurism it is necessary to produce a coagulum that will fill the greater part of its cavity. Nothing less than this will do; that all physicians know; they also know that the galvanic current is one of the most powerful agents we are possessed of for causing coagulation of blood, and to this end the galvanic battery is frequently used. But how is it used? Here is a specimen of an ordinary report of a case: Mr. A. B., æt. 40, admitted into ——— Hospital on November —— 1876; aneurism of arch of aorta. Four insulated needles connected with the positive pole, and three with the negative of a battery of six cells (or six cells of a certain kind) were inserted into the tumor. After five minutes the current was increased to twelve cells, and allowed to flow for half an hour uninterruptedly. The patient died next day. What do we learn from this? Simply that electro-puncture was used on a case of aneurism, and that the patient died—nothing more. We are not given the least information as to the amount of actual current flowing through the circuit in a

minute or in an hour; consequently we do not know how much of a coagulum was produced by the operation, nor how much of this was broken up by the withdrawal of the needles.

The amount of current can only be calculated by Ohm's law, viz., $C = \frac{E}{R+r}$, so that if R + r are unknown, C remains still an unknown quantity, even though we know the exact E. Consequently the work done, or, in other words, the amount of coagulum produced, remains an unknown quantity.

For the benefit of those who as yet have not given the subject of electro-surgery much attention, and to make our meaning still more clear, let us follow out a very simple electrolytic operation, viz., the effect of the galvanic current in decomposing water. We are all aware that when a galvanic current is passed through water (the water, of course, being part of the circuit), that it is decomposed, the oxygen being liberated at the point where the metallic part of the circuit connected with the positive pole makes contact with the water, and at the point of contact of the negative electrode, the hydrogen is liberated. The rate at which the decomposition takes place is in the direct ratio of the amount of current flowing through the circuit in a given time. A veber of current will decompose .00142 of a grain of water in a second. Suppose, then, we have a battery of six Daniell's cells, and the internal resistance of each cell is 5 ohms, and of the external part of the circuit, viz., the water between the electrode including the terminal wires of the battery 30 ohms, how much current is passing in a second of time? How much water is decomposed? The equation reads thus:

$$C = \frac{6\,E}{6\,R + r} = \frac{6}{30 + 30} = \frac{6}{60} = \frac{1}{10} \text{ veber per second.}$$

Water decomposed, .000142 of a grain per second.

Now suppose with the same battery we increase the external resistance to 70 ohms by moving the terminals of the metallic part of the circuit further apart, what a difference it makes in the amount of current, and in the amount of work done.

$$C = \frac{6\,E}{6\,R + r} = \frac{6}{30 + 70} = \frac{6}{100} = \frac{3}{50} \text{ veber per second.}$$

Water decomposed, .0000852 of a grain per second, and so on, every time we add to the resistance, we diminish the quantity of current; and if the resistance be added in an unknown quantity, the current is diminished to an unknown quantity, and the amount of water decomposed, of albumen coagulated, of tissue destroyed, of metal deposited, of heat, light, mechanical motion, magnetism produced, or of other work done, remains unknown. So the result of an operation on living tissue, performed in the way above recorded, becomes a matter of chance, the probabilities of success being decidedly in the minority. How then are we to make it otherwise? By making up our minds beforehand the effect we want to produce, and by calculating the exact amount of current and time it will take to produce that effect. In order to do this, all that is necessary is to measure the electro-motive force of the battery, and the internal and external resistances of the circuit, *knowing beforehand the amount of work that a certain quantity of current will do* in a given time. This involves a knowledge of electro-physics, an acquired skill in manipulating the delicate instruments used, the necessity of being provided with the materials for conducting the operation. But success in electrolytic operations can only be assured by complying with the natural laws which govern electricity, and we cannot too strongly urge upon those who intend making electro-therapy a special study, to familiarize themselves thoroughly with these laws and acquire dexterity and absolute accuracy in using electrical instruments, before operating on living tissue. By doing so they will only do justice to their patients, themselves, and to the profession, and acquire that true experience which will prove of value to the profession and to humanity. By not doing so their operations will only be miserable failures, experience will bring no new knowledge of the subject, they will treat themselves unfairly, those under their charge dishonestly, and bring disgrace upon the cause.

The object of this journal is to supply the deficiencies of our literature, aiming at the attainment of absolute precision in all the departments of electro-therapy, basing all conclusions upon the fundamental laws which govern electricity, upon the effects

which have been observed produced by certain quantities of current upon the living organism, upon organic material, and upon the chemical decomposition of inorganic matter so far as this latter is likely to prove of service in the treatment of disease. Although the journal is intended more particularly for the specialist, every number will contain one or more articles for the use of the general practitioner and for the student and beginner.

The first electrical successes having been made in diseases of the nervous system, turned the minds of physicians to electricity as a remedy in these diseases, and naturally enough electrology and neurology have grown up together, bound by inseparable ties, which we have no inclination to sever.

Part of each number of our journal will therefore be devoted to neurology; and a synopsis of all that is new and useful in this department will be given, both in the form of translations from foreign periodicals, and gleanings from the various papers of this country and England, as well as original articles from the pens of the best authorities on the subject.

N. B.—THIS paper is not published in the interest of any individual, clique, school, or party, nor is it the mouthpiece of any society, but has been established purely in the cause of science. Its pages are open to all who will contribute anything new to the cause, and the editor will thank those of his brethren who will send any communication (whether in the shape of an original essay, or exact notes of clinical cases) that will help to throw new light on the important subjects to which the paper is devoted.

ALL exchanges, books for review, electrical and other instruments for editorial notice, and communications of a professional nature should be sent to the editor, 102 East Twenty-second Street, New York.

Advertisements and all letters pertaining to the business part of the journal must be addressed to the publishers, Boericke & Tafel, 145 Grand Street, New York.

OUR next number will probably contain "How to Perform Electrolytic Operations," by the Editor. "The Uses of Electricity in Aural Affections," by Dr. H. C. Houghton, New York. "Treatment of Hydrocele by Electrolysis," by Dr. Murphy, New Orleans. "Metallo-therapy," a review of Charcot's experiments, by Dr. H. G. Millard, New York. "A New Theory of Seasickness," by Dr. E. P. Fowler. A clinical record of cases from various sources. A lecture on the "Electrical Treatment of Paralysis," by the Editor.

New Books and Instruments.

ELECTRICITY AS RELATED TO MEDICINE AND SURGERY. A. D. ROCKWELL, A.M., M.D. William Wood & Co., New York.

This little work is all it pretends to be, a mere introduction to the larger works on the subject. It does not undertake to teach, but rather to tell the student what he has to learn, and puts before him in a plain straightforward manner the value of the different forms of electricity in the treatment of disease in a general way, without going into detail. The author speaks rather slightingly of electrolysis in the treatment of tumors, especially malignant tumors, and certainly seems to undervalue this mode of treatment. He barely alludes to diseases of the eye, and says nothing about aural affections. Taken altogether, however, the work is an extremely useful one, and we hope it will find its way into the hands of every practitioner.

TWELVE LECTURES ON LOCALIZATION IN DISEASES OF THE BRAIN. BY J. M. CHARCOT. Edited by Bourneville. Translated by Edward P. Fowler. Pp. 133. New York. William Wood & Co.

The little volume before us is a model of the work that is being done for us by the French school—the pure pursuit of medical science; and it is in this department we may say that its most inviting field is laid out; for the medical art which flows from the pathology of cerebral lesions is sadly deficient, as evinced by the uncertain state of differential diagnosis and of prognosis in these affections.

In starting out, M. Charcot first lays down the complete method of investigation which he so strictly follows, and which renders his statements so positive. He first gives the results of minute study of encephalic anatomy, and discovers the lack of an exact nomenclature, whose wanting terms he furnishes.

Complementing the anatomy which fills the larger part of the volume, he details the results of experimental physiology, and completes the study of localization by furnishing the proof of correctness from clinical observations and autopsical examination. In doing this, M. Charcot freely opens his pages to the work of others, both foreign and native.

We need hardly say that the style is clear and vigorous, qualities which the translator has ably retained in the English version, as in fact the author says in a prefatory letter. The book will be a great aid to those wishing to report autopsical lesions with exactness. The new terms render this easy. The author first advocates vertico-transverse sections of the encephalon, and then names the important parts about the centre. The continuation of the foot of the peduncles previous to the divergence of their fibres is called the *internal capsule*. Above this are imposed the thalamus opticus behind, and the

nucleus caudatus of the corpus striatum in front, while below the peduncular fibres is the *lenticular ganglion* of the corpus striatum. The convolutions are fundamentally divided into the three frontal, the ascending frontal and ascending parietal on the respective sides of the fissure of Rolando, which ascends in a backward direction from the Sylvian fissure, below and parallel to which latter are located the three temporal convolutions of the sphenoidal lobe.

The fissure of Rolando divides the frontal from the parietal lobe; the latter in man is separated by a very irregular fissure from the occipital lobe. Beside the ascending convolution the parietal lobe contains the superior and inferior parietal lobules. But one convolution of the occipital lobe has received a name—the gyrus angularis, located just posterior to the extremity of the Sylvian fissure.

Upon the median face of the hemisphere the extremity of the two ascending convolutions form the paracentral lobule, while posterior to this is located the quadilateral lobule. The ascending convolutions and the paracentral lobule contain in greatest abundance the giant pyramidal cells of the gray cortex, whose protoplasmic basal prolongations become nerves in the medullary substance, and are continued to form the greater portion probably of the internal capsule, which is composed of three kinds of fibres, viz., direct peduncular from the cortex to the crura cerebri, fibres leading from the cortex to the gray ganglia, and fibres from the gray ganglia to the peduncles.

The destruction of the ascending convolutions and the paracentral lobule (ischæmic or embolic softening) has been found to give rise to the same permanent hemiplegia that lesion of the central ganglia does. We also have the same consecutive descending sclerosis of the cord that results from lesion of the internal capsule.

The destruction of the cortex elsewhere produces no paralysis, but if located in the occipital lobe gives rise to sensorial disturbance, notably hemianæsthesia. These facts lead to the belief that the giant pyramidal cells, which are mostly found in the ascending convolutions and paracentral lobule, are for motion, while the largely predominating *globular* cells of the occipital lobe are for sensation.

In lesions affecting the posterior third of the internal capsule, which always produce a crossed hemianæsthesia, the presence of a fasciculus of direct fibres going to the occipital lobe is shown, while the crossed amblyopia commonly present is with great probability attributed to an implication of the posterior radiating fibres of the optic thalamus, lying immediately over this fasciculus, which fibres (optic expansions of Gratiolet) constitute the deep root of the optic nerve. The fact of a crossed amblyopia instead of homonymous hemiopia is accounted for by a theory (supported by facts) that the

part of the optic nerves not decussating at the chiasma cross further back, probably at the anterior tubercula quadrigemina. Impairment of the other special senses on the side opposite to the lesion is to be similarly explained in all probability.

The vascular system, which may be said to command the situation, in cerebral pathology, receives a large share of attention, five lectures being devoted to it.

While stating the greater frequency of hæmorrhagic than embolic apoplexy in the centres (6 to 1), and the reverse as regards the cortex, the author offers the anatomical explanations, that on the one hand the vascular distance from the heart to the central masses is short, while the blood-current passes through a long series of meningeal vessels before reaching the cortex; on the other hand emboli readily enter the meningeal arteries, which divide dichotomously, and escape the arteries of the central masses, which are given off at right angles to the main trunk.

The general lack of anterial anastomosis, even down to the capillaries, is reaffirmed after a careful examination of the subject, and as pathological proof of this he evidences the rarity of recovery from even slight embolic apoplexy.

Apoplexy of the gray central ganglia which is not so extensive as to produce much extraneous compression the author states is transitory in its effect, while it generally gives rise to a total hemiplegia, thus proving that one central ganglion may take the place of another, or a part of the whole.

A larger clot, producing simple compression upon the internal capsule, will also cause a temporary paralysis, the recovery from which depends upon the absorption and relief from pressure, while a destructive lesion of the internal capsule produces a permanent hemiplegia with consecutive descending sclerosis of the cord and late (14" to 30" day) contractions (contracture) of the muscles, when affecting the anterior two-thirds, or a crossed hemianæsthesia with impairment of the special senses on the side opposite to the lesion when affecting the posterior third of the internal capsule.

The diagnosis between cortical (generally embolic) and central (hæmorrhagic) lesions is not often to be made; the latter is generally the case where hemianæsthesia is present with paralysis. The difficulty is no doubt due to the fact that the central ganglia are engaged in the same work as the gray cortex, to the nerve-prolongations of which (internal capsule) they may be considered appendices.

The volume has the general neatness displayed by the works of its publishers, except in regard to the plates, which are simply blotchy. Taken as a whole, however, we must say of the work that it is a very lucid exposition of a very difficult subject. W. Y. C.

Miscellaneous Items.

OVARIOTOMY SUPERSEDED.—A proposal has been brought before the Paris Academy of Science by M. Tripier to establish a fistula between the cavity of an ovarian sac and the exterior. He has tried it in one case with success. The interior of the sac can in this way be washed out, or treated with iodine injections or cauterized. He has used injections of iodized water daily. The galvano-caustic is used to establish the fistula. This operation is less formidable than ovariotomy, and can be easily carried out, but, of course, is not devoid of danger; but it may be applicable in cases where gastrotomy is refused or inapplicable. With regard to injections they should not be too strong. We may point out that death from poisoning by iodine has been recorded where the drug was injected. This operation may be compared with electrolysis for ovarian dropsy.—*Physician and Surgeon.*

WHO IS HURT MOST?—Some few months ago Dr. Moses Pardee, of South Norwalk, Conn., was arraigned before his County Medical Society, charged with certain high crimes and misdemeanors, the most outrageous of which were, that the doctor's wife, Dr. Emily Pardee, believed in the law of similia similibus, etc., and that the accused actually had the audacity to consult with her.

There were two or three other minor "counts" not sustained by evidence.

The County Society expelled the doctor, but he, fully believing that it had no right to do so, made an appeal to the State Society, and that learned and august body, at their June meeting, sustained the action of the County Society.

We never knew before that a man *could* be held responsible for the opinions of his wife. We are glad, however, to see a precedent established, so as to know exactly where we stand. What is to become of the rest of us whose wives have opinions of their own? All to be expelled from the societies to which we belong? What a terrible fate to contemplate! The medical societies of the United States will then consist of old bachelors (we almost wrote old fogies), a few old widowers, and those whose wives have no opinions of their own. We hope they will have a good time together, and assist each other in promoting the cause of science, the good of humanity, freedom of opinion, and entire liberty of thought and action. We offer our congratulations to Dr. Pardee on the recovery of his untrammelled liberty. Our sympathies are with the Society, which, by its own action, has lost a member who for twenty-five years has been a credit to it and to the profession.

THE ANATOMY OF THE MALE CHIMPANZEE.—In dissecting a male chimpanzee that died lately in the Zoological Garden at Phila-

delphia, Dr. Joseph Leidy has discovered several hitherto undetected peculiarities. It is certain that they did not appear in the structure of the female specimen recently dissected by Dr. Chapman. That gentleman found the chimpanzee brain to clearly resemble the brain of man, with the exception that the cerebrum did not cover the cerebellum. This coincided with the report of a distinguished anatomist who dissected a champanzee many years ago. Dr. Leidy, however, finds that in the male chimpanzee the cerebrum does cover the cerebellum, indicating a greater brain power in the male than in the female, and he infers, accordingly, that the anatomy of the male chimpanzee has never before been examined and reported on. Dr. Leidy also finds the vocal organs of the male to differ greatly from those of the female, particularly in the possession by the male of a natural bagpipe, communicating with the larynx, and extending to the breast, and into the arm-pits. This cavity is covered by powerful muscles. For the animal to increase the power of his voice it is obvious that only a slight motion of the arm would be necessary. On discovering this singular physical arrangement the professor wrote to the superintendent of the Zoological Garden to inquire if the male chimpanzee had any distinctive call or cry; to which the superintendent replied that the "voice of the male, for so young an animal, was simply enormous; its cry when enraged was loud, piercing, and shrill." It is a well-known fact, says Dr. Leidy, that this vocal arrangement is found in the male gorilla, the orang-outang, and the howling monkeys of Southern Africa, whose cry can be heard for miles.

On the 7th of May last, at the convention of the Psi Upsilon Society, in New Haven, Dr. J. G. Holland, the well-known author, and editor of *Scribner's Monthly*, delivered an original poem on the three professions. Below is an extract, published by kind permission of the author. It contains a deal of truth, as well as poetry. We would recommend its being inserted as an appendix to the Code of Ethics.

"Speaking of pills reminds me that a man,
About the time this century began,
Took what the world would call high ground and solus,
Proclaimed a war on pill alike and bolus.
He was as learned and as bright as any man,
And bore the homely name of Samuel Hahnemann.
And from that day his followers and friends
Have pushed their studies and pursued their ends,
Banned by the learned party in possession,
Who claimed to be the regular profession.
Let us not miss our golden opportunities,
But have a word about these two communities.
All quackery that thrives upon the earth,

Has in pretentious ignorance its birth.
On this, which gods and all good men abhor,
Let friendly scholars make eternal war.
A man is quack, and only quack, because
He practices a calling of whose laws
He has no knowledge, whose supreme offence
Is that his high profession is pretence.
It is too late in history and time
For learned opinion to be deemed a crime.
Too late for scholars to present their backs
To other scholars, as a school of quacks.
Too late for men, though under party banners,
To sacrifice their gentlemanly manners,
Or brand with insult men who hold a right
To treatment that shall be, at least, polite,
Forgetting that they sometimes fail, in fact,
And hold a science none can call exact.

"Well, after all our rhythmic chaff and chatter,
What is the grand conclusion of the matter?
That college training and a world of reading
Are valueless or worse without good breeding.
That though we call our dogs by pleasant names
Without regard to individual claims,
No learned name or title can confer
Respectability upon a cur,
Or purify his blood, or make him better,
Or even change him to a Gordon setter.
That in the three professions what is best
Is not the skill of which they stand possessed.
Is not, indeed, the learning which they hold,
Is not their power of winning fame or gold,
But simple goodness, Christian gentleness,
The disposition and the power to bless;
The qualities which, since the age began
Have made and kept the Christian gentleman."

In May last the New York County Medical Society admitted to membership a graduate of the New York Homœopathic Medical College, who possessed no other medical diploma. This, it seems, is the first case of the kind on record. It may not be so very long, after all (notwithstanding the action of the Connecticut State Society), until the now separate schools will "*agree to differ*" on the question of therapeutics, and one county society be deemed sufficient for *all* properly qualified physicians, no matter what their views may be as to how remedies act.

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Original Articles.

ARTICLE VI.

HOW TO PERFORM ELECTRO-SURGICAL OPERATIONS.

BY JOHN BUTLER, M.D.

BEFORE entering on the details of this subject it may be well to briefly enumerate the various uses of electricity in surgery, as well as the diseases that call for its exhibition.

1st. Electricity is used for the sake of its absorbent effects in the treatment of serous effusions, recent effusions of blood or of lymph, cystic tumors with watery contents, subacute and chronic glandular enlargements, and in any case in which absorption is interrupted.

2d. On account of its ability to coagulate albumen it is employed in the treatment of aneurism, nævus, and varicosis; and in cases of morbid growths, when the object in view is to produce "starvation" (as it were) of the tumor, by causing small coagula to form at several places within its structure; which coagula act as interrupters to the free circulation of blood

through the growth, and interfere with its nutrition so far as to render absorption more easy of accomplishment. Any benign solid growth, the removal or total destruction of which is, perhaps, injudicious, or at least undesirable, may be so treated.

3d. With a view of utilizing its escharotic effects, electricity is exhibited in malignant tumors, in hard fibrinous strictures of urethra, œsophagus, and rectum, and for the removal by electro-chemical decomposition of any morbid growth, whatever be its structure. From this list we would except osteoid or bony formations, as well as morbid growths which have undergone calcareous degeneration.

4th. In virtue of the capacity of electricity to cause muscular contractions, it is often called upon to break up adhesions, as in recent cases of partial anchylosis, etc.

5th. For the purpose of stimulating the process of repair, its effects are brought to bear upon indolent ulcers, and flabby granulations of an ulcerated surface.

Omitting a consideration of the use of the current for the purpose of heating metallic burners, actual-cautery knives, wire loops, etc., which will form the subject for another article, the above may be considered a list of the principal uses of electricity in general surgery.

Chronic Synovitis.

Electricity is now very generally acknowledged to be one of the most effectual remedies we possess in dispersing the effusion in this disease; both the galvanic and induced currents have been employed with success. Experienced electro-therapeutists have, however, discarded the latter, and use the galvanic current almost exclusively, on account of its being much more reliable and giving more prompt results.

Now as to the *modus agendi;* how are we to go to work? Suppose we have a case of this affection involving the knee-joint.

The procedure most generally adopted is, to place a broad

sponge electrode on each of the lateral aspects of the affected joint, having previously moistened them thoroughly with salt and water; secure them in position with a few turns of a roller, attach them to the poles of a galvanic battery (any form of cell will do for this purpose), and introduce the current, cell by cell, until the patient feels it sensibly; not so strong, however, as to produce pain; and, if the patient complains of the current being too strong, it should be reduced until the point of an agreeable tolerance is attained. A good rheostat is a convenient accessory, but may be dispensed with, and the only galvanometer we need, is the sensation of the patient. As to the length of time the current should be allowed to flow, it is impossible to lay down a definite rule. There is one thing certain, however, that we cannot do any mischief with a tolerably strong current in such a location, even with a prolonged seance, and we may fall short of our mark by not continuing our application sufficiently long. Therefore I would prefer in such cases rather protracted seances, say of twenty-five or thirty minutes each. These I am in favor of repeating daily. If, during the continuance of the treatment, the cuticle should be denuded by the repeated application of the electrodes, the location of contact may be changed by placing one of the sponges anteriorly and the other posteriorly on the joint. During the electrical treatment the extension of the limb by weight and pulley, as is usual, needs not be interfered with; nor should we be less assiduous with our internal remedies if actually indicated.

Another method is to bandage the joint firmly, with a roller moistened with water, in which a little salt has been dissolved, and over this apply a metallic bandage made of thick tinfoil or thin stencil plate. This foil is attached to the negative pole of the battery, and then secured in position by a dry bandage. The positive pole in this instance is a large sponge electrode, secured either above or below the joint. Otherwise the seance is conducted as in the first instance.

This mode of making the application is a very convenient one, and at the same time very effective. It is quite as appli-

cable to the wrists, ankles, and other joints, as it is to the knee, although these latter, as also the fingers, may be as effectively treated by immersing them in a warm solution of salt connected with the negative pole.

Enlarged Glands.

The late Dr. Maurice Colles, of Dublin, treated glandular enlargements by the use of very feeble currents, generated by small batteries made of zinc and copper wires wound on wood, covered with cloth or felt, and excited by being moistened with dilute Sulphuric acid or vinegar. A piece of metallic foil formed the negative pole, which was placed upon the gland, the positive similarly made on an adjacent part. The application was continued several hours and frequently repeated.

Moritz Meyer* preferred the use of the induced current, and, in published cases, clearly shows not only its effectiveness, but also its decided superiority over the galvanic current. Of other authorities the majority are also of this opinion.

As the result of my own experience I would say, that strumous glandular enlargements yield to the action of the induced current locally applied as they do to no other remedy; still they do not yield rapidly, but from the very first of the treatment some improvement is evident. The applications should be made daily, with moistened sponge or chamois-covered electrodes of a sufficient size to cover one of the affected glands. When only one gland is diseased, one pole (it matters not which) is placed on the gland, and the other on an adjacent part. When two or more glands are enlarged, both poles may be employed. The secondary induced current is decidedly to be preferred. As regards the length of each seance much depends upon the location. When the glands involved are situated near the head or neck, it is obvious that neither a protracted seance nor a strong current is advisable, on account of being unduly stimulating to the great nerve-

* Medical Electricity, p. 481.

centres; but when, on the contrary, this is not the case, strong currents (not painful, however), and long seances certainly should be the rule. Firm and steady pressure ought to be made with the electrodes during the whole sitting. The amount of pressure should not be altered on any account, as the slightest alteration not only varies the amount of current flowing through the part, but an unsteady application makes the treatment very disagreeable to the patient.

A sudden cure is not to be expected. The progress is usually slow and steady; some cases, however, subside tolerably rapidly until they have diminished about two-thirds, and then come to a standstill, as it were, the last third diminishing very slowly.

Enlargement of the Prostate.

Onimus* says: "In pure hypertrophy, electricity has not given us any very satisfactory results. But when the sequel of an acute prostatitis, or of a congestive process, the currents bring back the organ to its natural size."

Probably Onimus's want of success may have in a great measure been due to the mode in which he made his applications. He inserted one pole in the rectum and placed the other above the pubes.

In my own practice I have been in the habit of inserting a metallic-tipped electrode into the urethra, the tip being brought into contact with the prostate, and the circuit established by the other pole (a large olive-shaped rectal electrode) placed above the prostate in the rectum. I have used both currents successfully, and the results of my experience has led me to prefer an alternation of the currents to either one alone. I use both currents at the same sitting, commencing with a galvanic current of about $\frac{3}{1000}$th of a veber, continued for about five minutes, following this with weak induced current (without removing the electrodes) for from five to ten minutes more. In all cases when the galvanic current is used, *the negative pole*

* Medical Electricity, p. 132.

is the one to place in the urethra, for reasons that will be fully entered into when we come to speak of the treatment of stricture. With the induced current this is not of so much consequence.

HYDROCELE.

We find in textbooks a variety of opinions expressed regarding the value of electricity as a remedy in this affection. Some authorities extol it highly, while others say it is worthless except as a palliative, and compare it unfavorably with tapping. The reason of this appears to be, that those who operated successfully, hit upon the secret of success as a matter of chance, and without knowing it; while their more unfortunate confreres did not. What I call the secret of success is this: In all cystic tumors with serous contents, where it is necessary to introduce needles into the sac to produce absorption, and at the same time destroy the secreting power of the cyst; the needles should touch the internal walls of the sac, and be moved freely over it, so as to allow the electricity to act thoroughly upon the sac itself. When this is done, and the minor conditions of the operation fulfilled, a cure may be confidently expected. When these details are not attended to, the current will in most instances only act as a palliative.

The mode of operating is this: Insert two insulated platina needles into the scrotum, observing the rules for inserting a trocar. Allow a current of $\frac{3}{100}$th of a veber to flow, and commence to slowly move the negative needle around, so that the uninsulated part makes contact with as much of the lining membrane of the sac as possible. This being done, repeat the operation with the positive needle, allowing the negative needle to stand still in the fluid.

The strength of the current is a matter of importance; a stronger current might produce serious inflammatory action, and even suppuration, while a weaker one would not attain the object in view at all. A galvanometer should be kept in the circuit, a constant battery used, and as the current becomes greater or less, as it will, according as the needles are approxi-

mated or separated, it should be regulated by the rheostat, which should be conveniently situated under the operator's hand.

The whole time consumed in the operation, needs not be over ten minutes, even in the larger sacs. There is often some inflammatory action succeeding the operation, but I have never seen it progress to such a degree as to be at all alarming; however I make it a practice to keep the patient in bed a few days after the puncture. In one case the patient neglected this precaution, but got along well without any untoward results. The immediate effect of the operation is a rapid diminution in the size of the tumor; indeed, in every instance it subsides much more rapidly than when the sac is punctured without the current being used. The reason of this is obvious. The mixed gases generated by the decomposition of the water, by their pressure force the fluid of the cyst through the needle openings into the cellular tissue, where it becomes absorbed, this absorption being stimulated to a great degree by the dynamic action of the current. The fact of the fluid being rapidly absorbed should not form any point in the prognosis, for no matter how unskilfully the operation is performed this will take place, while a cure entirely depends upon the conditions above described being accurately fulfilled.

Ovarian Cysts.

There is no reason that I can see, why the rule just given for operating upon hydrocele should not apply to other cysts with fluid contents, *e. g.*, ovarian cysts; due allowance of course being made for the difference in size of the growths in the electro-motive force used. In the case of a large or medium-sized cyst, it would not be necessary to apply the needles over the whole of the internal surface at one sitting. A little can be done at a time. I have now under my charge a very large cyst that I am treating in this way. The patient is quite an aged lady, who, besides the cyst, has a number of other difficulties (any one of which she is liable to die of before I have time to cure the tumor). I have operated five times. At my

first visit she measured 45 inches around the abdomen, at the umbilicus. She now measures 38 inches. A report of the final result of the case with the details will probably appear in these columns at a future date.

The operations were performed in this way: Two insulated long needles, about 2 inches apart, were made to penetrate the abdominal walls at the most prominent part of the growth, one needle to each pole of battery. About $\frac{1}{32}$d of a veber of current per second, was used for about ten minutes at each sitting. The negative needle *only* was brought into contact with the internal wall of the sac.

In all such operations it is of course almost needless to say that the needles should be very thoroughly insulated. The reasons for this will be evident when we consider the parts that are perforated before the needle enters the cyst:

1st. The integument.

2d. The subcutaneous adipose tissue.

3d. Tendinous fascia.

4th. Peritoneum.

Now it is evident that while all the current may not be expended on these parts, and recomposition may not entirely take place in them, still they act as a shunt, and the action of a great portion of the current is expended upon them, and but a small portion is left to do the work on the internal part of the sac. This in itself ought to be a good reason for insulating the needles, even if we do not take into consideration the danger of producing an eschar in the peritoneum and its coverings.

I said that it was almost needless to say that the needles should be insulated. I would probably have left out the "almost," and said nothing about the self-evident facts, were it not that I attended an autopsy, some two or three years ago, of a woman who died of peritonitis from this precaution not having been taken; and that the physician who operated upon this patient actually said at a medical meeting, that "he thought it mattered little whether the needles were insulated or not."

There is another point I would call attention to; it is this: That the word "electrolysis" has been used to express the effect the current exerts in the cure of this disease. Now electrolysis has nothing to do whatever with the cure, as I think I can make evident to the merest tyro in this subject.

Electrolysis means electro-chemical decomposition, and consequent destruction of a fluid or semifluid. A veber of current is a quantity that will do a certain amount of work; for instance, will decompose .00142 of a grain of water. The resistance of the circuit in operation on an ovarian cyst may be made to vary from 30 ohms to 2000, according to the distance the needles are placed apart in the tumor, and the size of the needles; and may be influenced by a number of other facts which need not be detailed here. Now suppose we take the average electro-motive force that has been used by the physicians who have operated on these cases; as far as I can ascertain it is represented by 10 Daniell's cells. Call the electro-motive force therefore 10 volts, and the average resistance (with both needles introduced) 600 ohms, and the internal resistance of each cell 4 ohms.

$$\frac{\text{IOE}}{40\ \text{R} + 600\ \text{r}} = \text{C} = \frac{\text{I}}{64}\ \text{veber per second.}$$

It will, therefore, take this quantity of current sixty-four seconds to decompose a very small fraction of a grain of water, or coagulate a very small fraction of a grain of albumen; and suppose the operation be continued ten minutes and repeated fifty times, which is more than the average, the amount of current transmitted altogether would only be 468.75 vebers, a quantity which will decompose .66557 of a grain of water; and suppose we even multiply this by 100, what possible influence could the electro-chemical decomposition effected, have, in bringing about a disappearance of the tumor? I would therefore limit the meaning of the word electrolysis to its literal signification, and discard its use in reference to the operation in question, and call this operation "treatment by electro-puncture" to avoid confusion, and the use of one word to convey two distinct meanings.

There is absolutely nothing in medical literature on this subject that is worth reading. Dr. Paul Mundé has compiled all the available reading material that bears on it, in the second volume of the *Gynæcological Transactions*, page 348. It is only a compendium of blind experiment, from which one can learn nothing, except that most of the authorities quoted were lamentably deficient in a knowledge of the principles of electro-physics.

Stricture of the Urethra.

The use of the galvanic current in the treatment of strictures of the male urethra was first brought to the notice of the profession by Crussel in 1847. Mallez and Tripier soon afterwards took it up, and are said to have been quite successful. Many of their cases have been published. Crussel's method of operating was: Having ascertained the size of the stricture, and its distance from the meatus, etc., to introduce into the urethra, and down to the stricture, a rubber-covered metallic sound, the metallic tip of which protruded beyond the rubber covering. As soon as the tip of the instrument was brought into contact with the stricture, it was made the terminal of the negative pole of a galvanic battery. The circuit was established by the positive terminal being placed in the patient's hand. The current (?) was allowed to act for from ten to twenty minutes every day, until the stricture was cured, which desired result, he claims, took place in from eight to ten days.

Tripier used the following modification of this procedure: On the rubber-covered sound he used an olive-shaped tip of gold or platinum, and made the circuit by the positive pole being placed in contact with the pelvis. He employed a current of sufficient strength to produce a decided eschar; and it is said that in many instances he obtained good results.

Dr. Newman,* of this city, slightly modified Tripier's opera-

* Archives of Electrology and Neurology, May, 1874.

tion, used weak currents, and allowed long intervals to elapse between the applications.

It will be noticed that each of these authorities treated all their cases alike, making no distinction between the treatment requisite to produce absorption of a recent soft stricture, and that necessary to cause electro-chemical decomposition of an old, hard, fibrous one. And although these operators had undoubtedly a large number of successes, they must, judging from their loose generalization, certainly have had, by overdoing or not doing enough, quite a large proportion of cases which turned out unfavorably. This want of discrimination on the part of the pioneers in this department has led to much blind experimenting by men whose knowledge of electro-physics is confined to the facts that a battery can be purchased for so many dollars, and that the negative pole is good for strictures. These men, after applying their poor battery and illy-adapted electrodes, and finding that the strictures did not melt away under the influence of their magic wand, aided by their acquired skill and technical ability, condemned the use of electricity in no measured terms, and really doubted whether it was of value as a remedial agent in any disease whatever. And not only have they cried down electricity as a remedy, but those whose skill, knowledge, and experience gave them such confidence in it as to use it in suitable cases, they decried, either as idle dreamers, or charlatans and men unworthy of confidence.

This ignorance and egotistical assumption has done much to retard the progress of medicine in other departments (Materia Medica, for instance), as we well know, and it has not been without baneful effects in the department in question, and has undoubtedly done much to prevent electricity from being now *the universally acknowledged remedy for stricture of the urethra.* But although truth may be bitterly opposed, and may be apparently drowned by prejudice for a time, it is certain to rise to the surface in the end, and shine all the brighter through having shown its ability to withstand the opprobriums of ignorance and prejudice.

The time is not far distant when electrization, skilfully and scientifically used, will be the universally acknowledged remedy for strictures of the urethra, and in the coming text-books on surgery it will be shown to far surpass the old mechanical means for restoring the permeability of the urethral canal: and the old methods of divulsion, forcible dilatation, etc., will by-and-by hold the same relation to urethral surgery, that Heathen Mythology does to the religion of to-day; taught in our schools only as matters of historical interest, belonging to the literature of a bygone age.

The rule governing the treatment of strictures by the galvanic current is in no sense different from the rule governing other electrical operations and experiments, viz.: The amount of work done is strictly proportional to the amount of current used.

Sir Henry Thompson* makes two divisions of stricture, viz.: *Permanent* and *transitory*.

He defines a permanent stricture as "a contraction due to organic deposit in or around the walls of the urethra, which has no tendency to disappear by any natural action or function of the body;" and describes a transitory stricture as "a contraction due either to local vascular inflammation or congestion, causing temporary narrowing of some part of the urethra; hence inflammatory or congestive stricture is spoken of; or to unwonted muscular action of the voluntary or involuntary fibres, in which case it has been designated spasmodic stricture." He further describes the formation and progress of a permanent stricture (which is the only form we shall discuss in this paper), and says:† "The first effect of inflammation upon the mucous membrane is a swelling or thickening of it, caused by engorgement of the vessels, then exudation of an albuminous fluid takes place into its substance, and especially into the tissues beneath, which may no doubt become absorbed under favorable circumstances. But when the morbid action persists, more or less plastic material is thrown out, which becomes organized, forming a firm fibrous tissue around the canal,

* Stricture of the Urethra, p. 64. † Op. cit. p. 69.

causing adhesion between the mucous membrane and the submucous tissue, infiltrating the meshes of the latter, and even involving the substance of the corpus spongiosum itself; while repeated or long-continued attacks of inflammation may cause it to extend throughout the entire thickness of that body, rendering it tough and dense to an extent, in some cases, almost beyond belief."

From this description it will be readily seen that stricture is capable of being divided into two stages, the first stage being, when the stricture is recent, soft, and semifluid, and the second stage commencing when the plastic effusion has become organized, and the contraction has grown fibrous, hard, and solid. It is necessary that a division of this kind in the progress of a stricture should be adopted, in order to be able to define the entirely different actions required of the current for the cure of recent albuminous strictures, and for those that are hard and fibrous.

Having diagnosed a stricture as being soft and semifluid, by the history of the case, touch, etc., and ascertained the anatomical site of the contraction, the length of the stricture, and the relative size of the contracted portion of the urethra compared with the healthy portions (which latter is best done with Otis's urethra-meter), we are in a position to make an application of galvanism *with a view of producing absorption.*

The method I adopt is this: Select an electrode insulated except the tip, the uninsulated part being the length of the stricture, and of such a diameter as to make contact with the mucous membrane without exercising forcible distension. It may be *slightly* tapered toward the end. The insulated portion (also tapering) must be of so great a diameter as not to allow any part of it within the stricture.

The patient being placed on his back, the instrument should be well lubricated, and passed down to and *into* the stricture.* When we are satisfied that the active part of the elec-

* In case there is any difficulty in getting the tip well into the contraction, or when false passages exist, the instrument should be passed upon a filiform guide; a channel for which is cut in the tip.

trode is properly located, we place a sponge connected with the positive pole of the battery underneath the patient's gluteal region, and connect the urethral electrode with the negative. Introduce the current gradually, until the galvanometer shows that $\frac{1}{1000}$th of a veber is flowing. This may be increased in some cases to $\frac{2}{1000}$th or even $\frac{3}{1000}$th. Beyond this it is better not to go; it certainly is unnecessary to use a stronger current; it only needlessly electrolyzes the urethra. As to the length of the seance, five to ten minutes will usually be sufficient. The weaker the current the longer the time, and *vice versa*. The patient should be examined in about a week after this operation, when it will be found that the stricture will admit a larger instrument. In some cases, several numbers larger. If the contraction has entirely disappeared, then our object is accomplished; if not, the operation should be repeated at intervals of about a week, until the calibre of the canal is restored. In no case need pain be produced, unless, indeed, the urethral canal be very irritable, and then the pain is entirely due to the touch of the instrument and not to the action of the current, which relieves the irritability markedly. When a stricture has become fibrous and hard, such an operation will not answer.

The operation I use for fibrous strictures, and for which I claim entire originality, is a means (which I shall describe presently) by which a stricture can be divided through its entire length, at one or more points in its circumference, through its entire thickness, without pain, without hæmorrhage, without division of the meatus, without tendency to re-formation, by a means that prevents the divided parts reuniting, and so forming a new stricture, and by a means that will so act upon the remains of the stricture as to hasten the absorption.

It will no doubt be conceded that any operation which fulfils these conditions, is infinitely superior to any hitherto used.

The instrument that I have designed for this operation is shown in the engraving. It is a hollow sound, entirely in-

sulated, having a slot about two inches (more or less, as the case may require) long; in this slot are a pair of concealed wires which can be made to separate and protrude in their long measurement, so as to form an ellipse by turning the nut from left to right. This ellipse, owing to the great flexibility of the wires, adapts itself to the shape of the stricture. There is a groove and eyelet in the tip, *b*, to allow the use of a filiform guide. A dial on the staff just above the nut, *g*, indicates the degree of approximation or separation of the wires in millimeters. A long curved instrument is here shown with two active wires; but I have also had others made, short and straight, for operating on the dependent portion of the urethra, and others still, with one active wire, the one not intended to be used being insulated.

The mode of using this instrument is: Having ascertained the necessary measurements before described, pass the instrument into the urethra until the centre of the slot corresponds to the centre of the contraction; then turn the nut, *g*, so as to make the wires separate and firmly press on the walls of the urethra, but without causing distension. Attachment of the battery to the binding-post on the nut, *g*, causes the wires, *e f* and *c d*, to become the terminal of one pole, *which should be the negative.* The circuit is completed by the positive sponge placed on the nates, as in the former instance. All being *in situ*, a current of from $\frac{1}{100}$th to $\frac{1}{50}$th, or even more, of a veber is allowed to flow. After flowing a short time, it will be found that the instrument has become loose in the stricture. When this is observed the nut, *g*, should be further turned, so as to make the wires protrude still more, until the instrument becomes tight again. The loosening of the instrument is due to the escharotic action of the current, the water decomposed, and the albumen coagu-

lated, etc. The amount to which the wires can be separated from the centre of the staff after the instrument has been fitted to the stricture represents about half the depth of the eschar produced; that is to say, suppose the wires have each been separated from the staff to a distance of one millimeter, there have been two millimeters in depth of the tissue forming the stricture destroyed, part of which tissue has, during the decomposition consequent upon the action of the current, been given off in gaseous form, part in the form of a viscid frothy material, and part remains as a slough, to go through the usual process of separation after a few days. The size, then, of the piece of tissue destroyed is in depth equal to double the distance the wire can be separated from the centre of the staff, after becoming loosened; and as the electric current acts equally on all sides of the wire, it is fair to presume, that the amount of tissue destroyed on each side of the wire would be equal to the amount underneath, were the contact equal in both instances; but as the contact is not efficiently kept up laterally; it follows that the destruction of tissue on the sides of the wire is less than in the direction of the expansion. Say if one of the wires has been separated from the centre of the staff after loosening one millimeter, there has been destroyed a portion of tissue two millimeters in depth, and two millimeters (in round numbers) in thickness, making no allowance for the thickness of the wire.

I fancy I hear my readers already saying: That's all very well, but how do you know it? How are you going to prove it? I will tell you how I discovered it.

I observed that, when electrolysis was performed on tissue, *e. g.*, fibrous tissue, by needles from each pole of the battery, that the needles from the negative pole became loose, and that if at any time during the operation one of the needles were withdrawn, the hole left much exceeded the size of the needle, and, further, that around this hole was a perceptible amount of eschar, which bore a constant proportion to the diameter of the hole. This proportion roughly estimated was, that the diame-

ter of the eschar equalled the diameter of the hole, less the diameter of the needle. Never having pushed the action of the current beyond the production of a slough of a few millimeters for each needle, I am unable to state whether these facts are to be observed in the case of very large eschars; but the proportion holds good in the case of much larger sloughs than it is ever necessary to produce in any case of stricture. It is evident that if the foregoing data be attended to, and the measurements made correctly, that any fibrous stricture can be wholly cut through electro-chemically at one sitting.

For various obvious reasons this may not be always advisable; or, owing to spasm, a mistake may be made in the measurement of the calibre of the stricture; such being the case, the stricture must be again operated upon, until sufficient electro-chemical action has taken place. The pain attending the operation is but trifling, and in some cases is not complained of at all. The hæmorrhage is never more than often occurs from the passage of a sound, and, in the majority of instances, no bleeding whatever occurs. Of course some trifling inflammatory action follows the operation, but this is nothing to be compared with what takes place when Tripier's method of sloughing out the whole circumference of the stricture is used. Indeed, I have never seen the inflammatory action cause any trouble whatever. The use of bougies for the purpose of preventing union of the divided surfaces is unnecessary, as the surfaces are not in close apposition, nor is there any tendency to re-formation of the stricture through cicatricial contraction; as it is well known, that a surface healing after the separation of an eschar caused by the action of the negative pole, does not contract in healing. The remnants of the stricture, stimulated by the dynamic action of the current, soon become absorbed, and so the calibre of the canal is restored to its normal condition. In the following table the merits of this method of treatment may be compared with dilatation, divulsion, and internal urethrotomy:

SLOW DILATATION BY SOUNDS.

A very slow process.

Many and frequent sittings necessary.

To be of any effect the meatus must be divided, or else there is no possibility of stretching the diseased part to the normal calibre.

Tendency to re-formation strong, the probabilities of return being in the majority.

No means of ascertaining whether the urethra is simply stretched or lacerated.

DIVULSION.

A good deal of pain.

Hæmorrhage.

More or less shock.

Often urethral fever.

No possibility of telling whether the stricture is entirely torn through, or whether the healthy parts of the canal have been lacerated.

Division of meatus necessary, also the frequent use of bougies after operation.

Strong tendency to cicatricial contraction.

Many sittings requisite.

No guarantee of cure.

INTERNAL URETHROTOMY.
OTIS'S METHOD.

Pain.

Hæmorrhage, often profuse.

More or less shock.

Often urethral fever.

The divided parts being clean-cut surfaces in close apposition, frequent tearing apart is necessary to prevent them uniting.

Division of meatus necessary.

Remnants of stricture become slowly absorbed when the divided parts are kept well asunder, but there is some tendency to cicatricial contraction.

Several sittings and long after-treatment requisite to cure the stricture.

ELECTROLYSIS.
BUTLER'S METHOD.

No pain, or very little.

No hæmorrhage.

No shock.

But little liability to urethral fever.

The subsequent use of bougies unnecessary.

No division of meatus necessary.

No tendency to re-formation by the parts uniting by the first intention.

No tendency to re-formation through cicatricial contraction.

The stricture can be cured in a few sittings, and but little after-treatment necessary.

There are a few cautions to be observed in electrolyzing a stricture:

1st. A galvanometer should be used that will indicate exactly the amount of current flowing.

2d. An adjustable rheostat, by which the flow of the current may be steadily kept at the same point, should be in-

cluded in the circuit, and so arranged as to be quite under the control of the operator.* This is a matter of great importance, as during the process of electrolysis the resistance of the circuit is constantly changing, owing to change in the conductivity of the chemically altered tissues.

3d. The electrodes and accessories should be *in situ* before the current is allowed to flow.

4th. The current should be let on gradually at the commencement of the operation, and reduced gradually at the close; and shut off entirely before removing the electrodes.

When this operation is carefully performed by an expert, it will readily be seen that it must be a success in all uncomplicated cases; but when undertaken by an inexperienced or careless operator, the field is a good one for doing an amount of mischief that in other hands would be avoided.

(TO BE CONTINUED.)

ARTICLE VII.

TREATMENT OF SOME EYE DISEASES BY MEANS OF ELECTRICITY.

BY J. H. BUFFUM, M.D., RESIDENT SURGEON, NEW YORK OPHTHALMIC HOSPITAL.

A REVIEW of the literature of electro-therapeutics in its relation to ophthalmology shows conclusively that although electricity has not won extensive favor from oculists in the past, it is now rapidly becoming recognized as a valuable remedial agent in the treatment of many eye affections.

Since the days of the old galvanists, who expected from the voltaic pile the immediate solution of cataract and the dissipation of the black cloud which covered the eyes of the amaurotic, the history of electricity as a curative agent in diseases

* The rheostat described under the heading "New Instruments," is especially adapted for this purpose.

of the eye presents the same periods of popular favor and disfavor which have marked the progress of electro-therapeutics in its relation to general medicine. Within the last few years, however, through the endeavors of modern electro-therapeutists, who by thorough investigations upon healthy and diseased subjects have given the necessary basis for the foundation of a rational mode of treatment, its sphere of action is becoming better defined and its usefulness more apparent.

The anatomical position of the eye, and the extreme sensitiveness of the conjunctiva, render the localization of electrical currents upon its parts more difficult than that of almost any other portion of the body; yet the wide range of diseases of the eye which have been reported cured by the induced and constant currents, shows that there is much to be expected from their proper application when guided by the knowledge obtained by scientific research.

Paralytic affections of the ocular muscles have naturally received the most attention in the application of electricity as a curative agent in affections of the eye. In paresis and paralysis of the muscular appendages of the eye, the cases which have been found most amenable to treatment are those which are due to peripheric rather than central causes. Among the peripheric causes, rheumatism and syphilis afford the largest number of cases, and are the most readily relieved. Where the paralysis depends upon some central lesion, as of the brain, the galvanic current may keep up a certain amount of contractile power in the affected muscles, which, however, soon subsides unless resolution of the intracranial disease takes place.

The success of the electro-therapeutical treatment depends almost entirely upon the method of application and a knowledge of the effects produced by the currents upon the eye.

The electrical current may be made to affect the eye in three ways,—directly, indirectly through reflex action of the trifacial, and through the superior cervical ganglion of the sympathetic.

In the usual method for direct irritation of the affected part, the positive electrode is placed upon the back of the neck,

while the negative is moved gently over the closed lids in the region of the affected muscles.

For the indirect, the anode is applied to the forehead, and the cathode moved over the skin around the eye.

Galvanization of the sympathetic on one or both sides, is produced by placing the anode upon the nucha, and the cathode upon the upper cervical ganglion, at the angle of the jaw of either side.

In general the best results are obtained by the direct application of the current through the head to the eye; yet all cases must be specialized, and the effects of electricity carefully studied.

With regard to the choice of currents, the constant galvanic appears the most rational, and seems to afford the best success. Some, however, prefer and report excellent cures by the use of the induced current. Under some circumstances the combined use gives excellent results.

The time of application of the current to the eye should always be short, from one-half to two minutes. The induced current may often be applied for a somewhat longer time than the galvanic, as the reaction is much less.

The number of cells to be used, depending upon resistance of the circuit and the sensitiveness of the patient, generally from five to fifteen Siemen's and Halske's cells are all-sufficient for the eye.

The treatment will produce a slight burning sensation of the lids as the electrode is passed over them, the patient experiencing flashes of light as the electrode is raised from the lid.

The currents should not be of sufficient strength, nor the sitting of such length, as to produce vertigo or headache.

The prognosis of the recent affections of the ocular muscles under the electrical treatment is very favorable.

When the *abducens* alone is affected, the cure is sometimes produced in one or two sittings. The paralysis of the other *recti* muscles may improve rapidly, the *oblique* muscles being less amenable to the treatment, while *ptosis*, with or without the

involvement of the parts supplied by the motor oculi, offers the least favorable prognosis.

In muscular asthenopia or insufficiency of the internal recti muscles the electrical treatment is a valuable auxiliary to the daily systematic exercise of the muscles, and frequently accomplishes gratifying results without the aid of medicinal treatment. The use of the constant current in this class of cases produces better results than the faradic, but there are some cases in which the latter gives relief not obtainable with the former. I consider it good practice in these cases, as well as many others, to follow a short application of the constant current by a trifle longer one with the faradic.

Chronic twitching of the lid and uncomplicated blepharospasm are frequently benefited by the faradization of the parts affected, and if of not too long standing may be promptly cured.

In cases of mydriasis, with or without co-existing paralysis of accommodation, there is often a momentary improvement immediately after treatment, but I have been unable to find permanent result, possibly from want of persistence in the treatment.

Article VIII.

ELECTRO-PHYSIOLOGY—A STUDY.

BY C. W. BOYCE, M.D., AUBURN, N. Y.

Electricity has two very prominent effects upon living animal tissues. First, a destructive effect upon both healthy and diseased tissue, and, second, a restorative effect upon deranged or diseased tissue. Its destructive effect is made use of by the surgeon in the removal of morbid growths by electrolysis and the galvano-cautery. Its restorative effect is made use of by the physician to a great extent, and perhaps principally, in strengthening and bringing back function when weakened or lost.

All moist substances through which electricity passes are

decomposed by this passage, and except near the electrodes are immediately recomposed. In this decomposition and recomposition no two equivalents which have been separated from each other are ever again reunited, but with military precision one set of like equivalents march one step towards one pole whilst the other set march one step towards the other pole. Where these two opposite equivalents come together they unite and form a new atom, only to be again decomposed, and taking up their line of march the next opposite equivalents, are reunited, and so on as long as the current continues to flow. In this onward march of equivalents at each step at either pole is liberated one equivalent, and thus there is an accumulation of like equivalents at either pole.

For instance, in the decomposition of water, oxygen accumulates at the positive pole or unites with the substance of which the electrode is composed, which if of metal becomes an oxide; whilst the hydrogen accumulates at the negative pole, and since it does not unite with this electrode it constantly increases in quantity.

When the electric current traverses animal tissue, there is a double decomposition. All animal tissue is pervaded by a solution of chloride of sodium, and this as well as the water which holds it in solution is decomposed, the chlorine arriving with the oxygen at the positive pole, whilst the soda and the hydrogen arrive at the negative pole.

Other decompositions take place wherever other salts are traversed by the electric current, and as a rule acids appear at the positive whilst the bases appear at the negative poles.

With this explanation of electrolysis we are prepared to understand Althaus's description of the results of experiments made by him during the years 1866 and 1867, where the changes produced by the electric current were observed by the aid of the microscope.

He says: "I have studied the action of the current upon the intimate structure of the skin and cellular tissue, muscular fibres and tendons, cartilages and bones, liver and pancreas, spleen and thyroid body, kidneys and suprarenal capsules,

testicles, breasts, and ovaries. The general result of these investigations has been that *no animal tissue whatsoever can withstand the disintegrating effect of the negative pole, and that the force and rapidity with which this disintegration is brought about are directly proportional to the motive force which is employed, and to the softness and vascularity of the structure acted upon.* Thus ten cells of a battery have a more thorough and rapid effect than five, fifteen more than ten, and so on; while, as regards the tissues, those containing most water, such as the muscles, the cellular tissue, the spleen, etc., are more rapidly disintegrated than those which contain less fluid. Bones and teeth withstand the action of the current for a considerable time."

"A curious and novel circumstance forced itself early on my attention, and this was, that the electrolytic effect of the negative pole on animal tissues was mainly composed of two different elements, viz., of the mechanical action of the nascent hydrogen, which was, under the microscope, seen to rise in innumerable bubbles as soon as the circuit was closed, and to force itself, as it were, between the structural elements of the tissues, driving their fibres mechanically asunder; and, secondly, of the chemical action of the alkalies, soda, potash, and lime, which, together with hydrogen, are developed at the negative pole of the battery."—Pages 39, 40.

"It was then observed that needles connected with the negative pole of the battery could be inserted into, and removed from, the body without causing any loss of blood; that the current used did not appear to give much pain to the animal beyond what was due to the introduction of the needles to the skin; and that the parts operated upon shrank sensibly after the operation, but that there was neither inflammation, suppuration, nor sloughing. If the current was made to act upon bloodvessels, it was found that they were filled with a foreign body, due to disintegration of the blood, and around which afterwards a slow deposition of lamellated fibrin took place; they were thus changed into solid strings wherever the current had been made to act. It appeared fair to conclude

from these observations, that the current could be safely and successfully applied to such parts of the body where shrinking and disintegration of tissue and obliteration of bloodvessels might be required for surgical purposes."

"The sores which are produced in the skin by the negative pole resemble those caused by caustic potash; and the same may be said of the cicatrices, for these latter have *no tendency to contract, but are soft and become gradually similar to the surrounding skin,* so that after some time no scar is perceptible, unless the action was originally very prolonged and very powerful."—Pages 41, 42.

In producing electrolysis, it is not necessary to introduce into the tissue to be destroyed any needles except those in connection with the negative pole, for, as is seen by the above experiments, no tissue can withstand the destructive effect of the negative pole. The positive pole may be a moist sponge applied to any indifferent part of the body; generally in the near vicinity. By the negative pole no foreign substance is introduced into the tissues, and we need fear no medication therefrom, since the electrode is not acted upon chemically. But, "the immediate effect of the electrolytic decomposition of any animal liquid is, that the anode (or positive pole) is oxidized and chlorinated, and from a metal changed into a metallic salt, since no metal can resist the effects of oxygen and chlorine in their nascent condition." By introducing needles in connection with the positive pole into animal tissues, "we may introduce into them salts of iron, copper, silver, gold, or any other metals used as directors, and which combine with the albumen to form albuminates."—Pages 42, 43.

In this description the effect of the negative pole is given where there is an independent battery in the circuit and the galvanic current is caused by chemical decomposition in this battery. The effect as described is at the electrodes. Our attention is called at this point to the difference between the direction of the current in and out of the battery. In the battery the current is from the zinc to the copper, and the oxygen goes from the copper to the zinc (by electrolysis),

whilst the hydrogen travels towards the copper. Out of the battery the current goes from the copper to the zinc, and the oxygen of any electrolyzed fluid goes to the pole in connection with the copper, whilst the hydrogen goes to that in connection with the zinc; as we see, the action is reversed. Now suppose, as is often the case, that we have an apparatus whereby animal tissue takes the place of the liquid in the battery. For instance, we take a plate of copper and a plate of zinc, and unite them by a copper wire. This we apply, perhaps, to the skin of a living person. We have in this arrangement a new battery, wherein the animal body with its fluids takes the place of the liquid in the ordinary battery. As soon as the application is made, chemical action takes place, and the solution of the chloride of sodium in the animal tissues is decomposed, the chlorine and oxygen going to the zinc plate, where decomposition immediately takes place, and we have formed the chloride of zinc. This is a violent escharotic and will destroy any moist animal tissue. Even so simple an apparatus as Garrett's disk will invariably create sores when left on the skin for a sufficient time.

In the electrolytic destruction of tissue the volume of electricity is necessarily considerable, and to be successful it ought to flow through the conductors as freely as is practicable. In electrolysis the action takes place *between* the electrodes, and not on the conducting wires. In galvano-cautery the action takes place on or outside of a continuous conductor. In the one the effect is from the passage of the current through the tissue itself; in the other the effect is produced by the passage of the current through the conductor, and this by producing an elevation of temperature. When a large quantity of electricity is made to flow through a fine platinum wire it is soon heated even to whiteness.

A battery which is adapted to produce electrolysis would be of no use for a galvanic cautery, and *vice versâ*. A battery adapted to produce the large quantity with small intensity required for galvano-cautery would be of no use in electrolysis.

In heating the fine platinum wire for the removal of tissue

or growths, care must be taken not to produce too intense a heat, for a white heat cuts through so quickly that the blood-vessels are apt to be left open, and hæmorrhage is liable to be the consequence. Where the heat is too little, the operation cannot be performed. When the heat is properly adjusted, any tissue is quickly removed without liability to hæmorrhage, and the surface is not left painful, because the exposed ends of the nerves are for a certain distance destroyed, thus preserving the sensitive parts from the irritating effects of the atmosphere.

No animal tissue can withstand the destructive effect of the galvano-cautery any more than that of the negative pole in electrolysis; yet the process is different. The tissue is destroyed by the galvano-cautery through the intense heat, and by electrolysis through chemical destruction.

Leaving this short sketch of the destructive effects of electricity, we pass to an investigation of the restorative effects of this wonderful agent.

"One great effect of electricity is its power to evoke function in all living tissue." (Poore.)

Function is the normal action of an organ or tissue. The function of an organ or tissue is active in proportion to the number of nerves distributed to this organ or tissue. A tissue to which few or no nerves are distributed has no independent function. For instance, the bones have no function proper; they are simply the framework which supports the other tissues that make up the completed organism. Without the muscular system the bones would be an inert mass, with no power of locomotion. The function of the muscles is to contract, and if we combine the bones and muscles properly we have an approach to an organism. Yet it is incomplete. If we add the nervous system, we then have all the parts necessary to complete locomotion. All the other organs are only necessary to give to the organism continued existence. *The nervous system constitutes the individual.* It is by and through the nervous system that all the functions of the different parts of the organism are evoked; and, in order to realize how electricity has the power

to evoke these functions, we must understand what the nervous system is (anatomy) and what it does (physiology).

The nervous system is composed of two kinds of matter, and these have entirely different functions. One kind is composed of cells, and these generate a force peculiar to itself. This force is the moving power of the whole system. The other kind of matter is composed of fibres, and these convey the force to its destination.

In order to impress the mind with the peculiarities of the nervous system we can do no better than to compare it with the batteries and wires of a telegraph company. Indeed, the cells are simply the nervous batteries, and the fibres are conductors. Familiarity with telegraphing makes it easy to study the nervous system by the help of this comparison. In telegraphing there is a head office from which all orders are issued, and to which all intelligence is returned. In the nervous system the hemispheres generate the will-power, and from them are sent all intelligent orders, and intelligence of what is going on is telegraphed back to these ganglia. In telegraphy there are as many different stations as there are places of doing business, and at each station are a greater or less number of batteries, according as the necessary business requires. In the nervous system are collections of cells whenever necessity requires to generate independent force for special purposes, and these collections are called ganglia. They correspond to the different stations in telegraphy. Each station is connected with the other stations and with the head office by conductors. All the ganglia are connected with each other and with the hemispheres by conducting fibres. In the telegraphic head office are the president, directors, and secretary. The hemispheres preside over the other ganglia, and here are the records kept. The second office of importance in telegraphy is that of the superintendent. It is here that all messages of a general character relating to the business of the company are received. All orders from the head office are here re-telegraphed. Corresponding to the superintendent's office is the ganglion or ganglia of the pons varolii or tuber annulare, and it is here

that all messages of sensation are received, and from these ganglia all motor messages are sent. The function of these ganglia is to superintend the business of the nervous system. All along the spine are important ganglia where nervous force is generated, and conductors take their origin in them.

There is one difference between the conductors of nervous force and those of the telegraph company. Nervous fibres conduct only one way. Telegraphic conductors conduct both ways. In all spinal nerves there are two sets of these fibres. One set conveying messages from the exterior to the centres, and the other conveying messages out from the centres. These are the sensory and the motor fibres. These two sets of fibres, although gathered together in the same nerve, are completely insulated from each other, and no outward-bound message ever interferes with an inward-bound one. But this fact of the two sets of conductors, the centrifugal and the centripetal, being always found together in the spinal nerves, must be taken into account where electricity is used in living animal tissue. The function of each set of fibres is to convey messages in its own particular direction, and, since a current of electricity evokes function, it follows that a current sent toward the periphery will evoke muscular contraction; while a current sent toward the centre will give the impression of pain.

We should endeavor to understand what is meant by "reflex action" as applied to the nervous system. This is, perhaps, best taught by an illustration; for instance, the secretion by the submaxillary gland. It requires three sets of nerve fibres in order that this gland shall perform its function and saliva be secreted. First, the chorda tympani, or gustatory portion of the trifacial, which is a branch from the seventh cranial nerve, is centripetal, and conveys messages by the central ganglia. But we find, on further examination, that it is not purely centripetal, for we find, on section of this nerve, that irritation applied to either end will cause a flow of saliva from the submaxillary gland. It would be very easy to understand the action of this nerve, provided that irritation of only one

cut end of the nerve produced function; for if merely the end, in connection with the gland, produced function, we should infer that this nerve was simply a mixed nerve, and that it transmitted both ways; and, further, that all the centrifugal fibres of the submaxillary gland were in this nerve. But, since irritation of both cut ends produce function, we see that there must be some other nerve containing centrifugal fibres distributed to the submaxillary gland. The origin of the seventh nerve is in the floor of the fourth ventricle, and it is to this vicinity that information is sent that saliva is needed. Somewhere in this vicinity is the origin or the situation of the ganglia from which arise the vasomotor nerves. Filaments of these nerves are distributed over the entire organism, and principally follow the arteries. The function of the vasomotor is to keep the arteries in a constant state of partial contraction, greater or lesser, according to the needs of the part; while dilatation of the arteries is effected by cerebro-spinal nerves, which are therefore called vaso-inhibitory, and which act upon the vasomotor centres to cause them to relax the contraction of the arteries. When, for instance, saliva is needed, the gustatory nerve telegraphs to the centre this necessity of secretion; this intelligence is reflected upon the vasomotor centre, and more or less paralyzing impulse is sent through its fibres to the arteries of the submaxillary gland, *i. e.*, the function of the vasomotor (which belongs to the sympathetic*), is lessened, and the arteries enlarge. More blood goes to the gland, and more saliva is therefore secreted. When the excitation (presence of food) of the centripetal nerves ceases, the sympathetic resumes its function, and the arteries contract and shut off the extra flow of blood to the gland; but irritation of the peripheral end of the cut nerve also produces an increase of saliva; this is probably to be explained by the paralyzing action of the fibres which go to the submaxillary sympathetic ganglion, for this ganglion has an intimate connection with the submaxillary gland. The

* Bernard, Küss, Legros.

impulse probably paralyzes the vasomotors going from the ganglia to the gland. All the functions of the organism are regulated in this same way. The nervous system is more or less directly a system of checks and balances. Each nerve has its antagonist, and in health these are evenly balanced, and the action of each checks that of the other.

The study of all-pervading function of reflex action forms a large part of electro-physiology. Seguin defines a reflex action as a transformation by nerve-cells of a sensitive impression (with or without consciousness) into motion, chemical action, or ideas. The parts essential to the performance of a reflex action consists of a centripetal (sensory) nerve to transmit the excitation, ganglionic cell to transform the impulse, and a centripetal nerve to carry this impulse to the muscle, gland, or cerebral convolutions. The results of the activity of such an apparatus are motion (common, muscular, or vascular), secretion, ideation. From this definition one can readily imagine that reflex actions occur in nearly every part of the body, in small segments of it as well as in large portions. A heart excised from certain animals will continue to beat for some time in response to irritation. Contraction may be obtained by irritating a small portion of intestine removed from the body; and a small segment of the spinal cord will suffice to give reflex movements to the muscles supplied by that piece of cord. Reflex action takes place in all parts of the nervous system (spinal axis, cerebrum, sympathetic system), and at all times; and it is through this kind of action that the most important bodily functions (including cerebration, in part certainly) are produced. There is a tendency to consider all active nervous phenomena of a reflex nature, denying the existence of spontaneity in the animal frame; and we must admit that a good deal can be said in support of this extreme view.

A full understanding of reflex action seems necessary to a complete appreciation of electro-physiology.

Function is evoked in the submaxillary gland by passing a current of electricity through the tongue, or if we experiment on animals and expose the chorda tympani, we pass a current

through this nerve. By this means a sense of gustation is conveyed to the centre, and from this centre through the vaso-motor nerves is transmitted paralyzing or dilating impulse to the arteries supplying the submaxillary gland. This is the most certain way to start secretion in the gland by electricity.

The direct antagonism of certain nerves to each other, is clearly illustrated by the action of the nerves distributed to the heart. Experiments have been so often made, and by so many different observers, with the same result, that there can be no doubt of the truth of the conclusion arrived at. The heart is supplied with nerves from two sources, viz., the sympathetic and the pneumogastric. Electrization of the sympathetic increases the pulsations of this organ, whilst electrical irritation of the pneumogastric slows and finally arrests these pulsations. Thus we find that the sympathetic nerve is the motor nerve* of the heart, and the pneumogastric the inhibitory nerve. At its origin the vagus is purely a centripetal nerve, and conveys messages by its own proper fibres only towards the centre. The spinal accessory, whose origin is in the immediate vicinity of the pneumogastric, is purely a centrifugal nerve, and conveys messages only from the centres. Near the origin of this nerve a branch joins the pneumogastric and follows it as far as the heart, to which it is distributed. It is this centrifugal branch which constitutes the inhibitory nerve of this important organ.

As we have seen, the motor nerve of the heart is the sympathetic, and when the action of this nerve is not antagonized by the inhibitory nerve, as when the vagus is paralyzed, we have rapidly increased pulsations, which are proportioned to the degree of paralysis. When there is loss of power in the sympathetic we find the number and force of the pulsations lessened.

The superior laryngeal or second branch of the pneumogas-

* The brothers Cyon, of St. Petersburg, proved that the branches of the inferior cervical ganglion terminate in the ganglion of the heart, that they are accelerators of the heart's action, and therefore antagonist to the pneumogastric. Journal of Hom. Clinics, vol. i, page 11.

tric is a sensory nerve. Of very great importance is a branch from this nerve which joins a branch coming directly from the pneumogastric. By the union of these two is formed what is called the depressor nerve of the circulation; this is a centripetal or sensor nerve telegraphing from the heart to the centre. When this nerve is divided, electrical irritation applied to the end in connection with the heart produces no results; applied to the end in connection with the centre it reduces the pressure in the arteries, diminishes little by little until it may be but to one-half or two-thirds of the normal pressure.

A peculiarity of all nerves is, that irritation applied anywhere in their length is manifested at their distribution. Irritation applied to a motor nerve produces contraction of the muscles. Irritation applied to a sensory nerve is manifested by sensation at its distribution. Electricity applied to the pulmonary branch of the pneumogastric (sensor) causes titillation in the bronchial mucous membrane, and by reflex this produces cough, sometimes of great violence.

One very important lesson may be learned from the application of an electric current to that part of the pneumogastric nerve going to the heart, viz., that a current of sufficient strength to arrest the pulsations soon paralyzes the nerve, and when this is complete the heart commences its pulsations again. This paralyzed condition of the nerve is called an electrotonus, and this condition is always produced when a current of sufficient strength is passed through a nerve.

The effect of the electric current at the two poles is not the same. At the positive pole is produced a benumbing effect or a lessening of nerve irritability; whilst at the negative pole is produced an exalted nerve irritability. These conditions affect that portion of the nerve which is included between the poles as well as to a certain extent outside of them. A portion of the nerve in proximity to the positive pole partakes of the lessened irritability, and that part in proximity to the negative pole partakes of the increased irritability. A neutral point separates the two. This point is determined by the strength of the current. With a weak current there is very little or no

benumbing or lessening of nerve irritability; the entire included portion is in a condition of exalted irritability and conducts more readily than in its natural state. This is called catelectrotonus. With a medium strength of current this neutral point may be midway between the points touched by the poles of the battery, and in this condition the nerve conductivity may be unchanged from its natural state, since what is lost by the lessening effect of the positive pole is made up by the increased activity of that portion in the vicinity of the negative pole. With a very strong current the benumbing effect of the positive pole includes the whole portion of nerve between the poles of the battery. In this state the conductivity of the nerve is arrested or nearly so, and its function is suspended.

In the therapeutical use of electricity this difference of effect at the two poles decides us in our choice of strong or weak currents. With a strong current we lessen function, with a weak one we exalt function. This readily explains why the heart resumes its pulsations when its inhibitory nerve takes on the state of an electrotonus, since in this condition the nerve cannot convey the force from the centre even, and has lost the increased functional activity which it at first received from the application of electricity. The sympathetic nerve remains intact, and reproduces the pulsation.

Although all kinds of electricity to some extent produce electrotonus, yet no reliable use can be made of any of the varieties for this purpose except the galvanic current. So unreliable are all other forms that we may assume that the galvanic current is the only one which will produce this effect, and do it always.

The question naturally arises, How does electricity produce its effect? It is not easy to answer this question further than to say, by a process resembling catalysis.

In chemistry, catalysis is the production of a decomposition, and following this is a recomposition of elements in some other form, by the presence of some other substance than those acting upon each other, and which substance does not enter into the chemical compound. This readily explains the effect of elec-

trolysis, but not the manner in which the function is evoked. All the vital processes, viz., digestion, nutrition, absorption, secretion, etc., are carried on by the aid of catalysis, and in all probability electricity is the force by which they are to a great extent guided.

The restorative effect of electricity! How shall we describe it?

"Remak's *catalytic* effects of the constant current are those which are produced by direct stimulation of the vasomotor nerves, which latter transmit the influence to the bloodvessels and lymphatics. In this way the processes of nutrition throughout the system may be influenced by galvanization. It appears to us that for *catalysis* we might substitute this more intelligible term, *catelectrotonus.* By catelectrotonus of the vasomotor nerves absorption is promoted, and effusions may be thus removed into the general circulation. Most probably the therapeutical effects of the current in rheumatism and in rheumatic gout, in dropsy of the joints, etc., are owing to what may be called *catalysis;* or, better, *catelectrotonus of the vasomotor system of nerves.*"

A current, not of sufficient strength to destroy living tissue, "starts a process that continues long after the current ceases to flow. The average ultimate effect is to increase the flow of blood, raise the temperature, and dilate the veins." (Beard & Rockwell.)

A current of electricity flowing through any liquid causes motion in this liquid, and this motion is from the positive towards the negative. Through experiment it has been found that by the use of the constant current, liquids can be made to pass through a porous diaphragm, and by the same agent fluids are made to change place in living tissue. Solids may be broken up and moved in the same manner, and by the general circulation thus removed and ultimately discharged by the emunctories.

It is the united testimony of electro-therapeutists that the weak current of galvanism is the curative one, and that when

harm comes from its use too strong a current has been used. I give a few extracts showing the view held in this respect:

"*It may be laid down as a general principle that a feeble current used for a short time produces the greatest therapeutic effects. A very powerful current almost always does harm instead of good, and more especially where it is applied for a considerable length of time.*" (Althaus, p. 329.)

"Benedict has justly laid stress upon the necessity of *short* applications (never more than half a minute). Meyer recommends an application of two or three minutes' duration; but this is for most cases too long. I am in the habit of employing the current from thirty to ninety seconds at a time. The result of the first or second application generally gives the clue as to what length of time the application should last; if the shortest time seems to answer it is not necessary to try a longer one, as sometimes the benefit already obtained is thereby counterbalanced." (Althaus, p. 331.)

"We do not usually observe any sensible contraction of muscles when under the *steady* running of a *feeble* current of galvanism. But this, as say Remak, De la Kive, and others, does not prove that there is not a certain effect being produced on the nerves of the steady and gentle inworkings of this current. Indeed, here, according to my experience, is one of the most marvellous and valuable effects of all the medical uses of electricity." (Garratt, p. 175.)

Article IX.

OPIUM HABIT—A TREATMENT AND CURE.

BY BUKK G. CARLETON, M.D.

The July number of your journal contained an article on the "Opium Habit," which called to mind two cases cured at the Ward's Island Homœopathic Hospital in 1877. One of these cases we lost all trace of when he left the hospital, but

the other case, which we shall detail in full, has been heard from at frequent periods, and to our best knowledge, at the present time, remains perfectly free from its influence.

Mr. B., æt. fifty-two, married, ship-carpenter, resident of New York city twenty-eight years; duration of his disease sixteen years. At that time he received a fracture of the right leg. As the pain in the injured leg was excruciating, his medical adviser prescribed Opium, which gave immediate relief. He was confined to his house for a year, owing to the severe nature of the injury, and during this period was under the influence of Opium most of the time. He had now become so addicted to its use, that he had no will nor inclination to relinquish the habit, as he was in torment whenever he went without his Opium or tried to diminish its quantity. Gradually, as new pains appeared and the prescribed amount of the universal panacea failed to produce the required effect, it was consequently increased in amount, until in March, 1876, his allowances had increased to twenty-five grains of Opium per day. At this time he placed himself in the care of Dr. Plimpton, and with her treatment refrained from its use for about nine months; but in December, while suffering from malaria and having taken a severe cold, Paregoric was administered. This at once aroused his old appetite, which gradually increased, until March 12th, 1877, when he was admitted to the hospital, he was using two ounces of the tincture daily. He had taken but little Opium in the previous two days, but from old trials he knew that unless he put himself at once in a position in which he could not procure Opium, either by persuasion or intimidation, his good resolutions would give way, and he would flee to his panacea only to plunge deeper and deeper into its use. At this time the countenance and integument presented the usual appearance of the Opium-eater; eyes uneasy, and had a wild expression, pupils contracted; mouth dry, but no thirst; tongue covered with a slight yellow coat; nausea was very prominent, but no vomiting; no appetite; the bowels, until within the previous twenty-four hours, had been very constipated, a movement occurring

once in every eight days. At this time there was a profuse blackish diarrhœa, which produced marked burning and excoriation of the anus; urine apparently normal; complained of slight pain in the small of the back and a sensation as though cold water was passing down his vertebral column (a sensation which has always made its appearance whenever he has tried for any period of time to discontinue the use of Opium); sleeplessness was very marked, but no headache was present; pulse 70; temperature $99\frac{1}{2}°$ F. ℞. Tarantula$^{\infty}$.

14th. Mental and physical restlessness marked; remained in no one position for any length of time; the chilly sensation in the back, together with the nausea, were greatly increased; complained of great coldness of the feet, which were found, on examination, to be cold and blue. During the night suffered with dull and sharp pains in the right knee; appetite very poor; yellowish diarrhœa frequent and profuse (having had fourteen stools in the previous twelve hours), which were preceded by a gnawing sensation referred to the umbilical region; pulse 58, small, thready, and almost imperceptible. ℞. Tarantula^{30}.

15th. Delirious, thought the nurse had been pumping water down his back all night, and could not be convinced to the contrary; dressed himself and wanted to go home; eyes wild and very glassy, pupils contracted; complained of a dull pain in the supra-orbital region, which was very hot to the touch; diarrhœa about the same; urine scanty and milky in appearance; pulse 70; temperature $99\frac{3}{5}°$ F. ℞. Same.

16th. The delirium had almost entirely vanished, and the headache was greatly ameliorated; eyes apparently normal; the wild and irresolute look had entirely disappeared, but as yet he had not been able to procure any sleep since his admittance to the hospital; complained of great mental and physical weakness and prostration; severe cutting pains in the umbilical region, which was very sensitive to pressure; diarrhœa cream-colored, but somewhat less frequent, followed by great tenesmus, after which there was relief to the umbilical pain

for a short time. During the night all sense of nausea had disappeared; pulse 65; temperature $99\frac{3}{8}$° F. ℞. Same.

17th. During the night had four hours' sleep, the first since he discontinued his Opium. He awoke with a dead aching numb pain in the forearms, especially the right and in both legs; weakness and pain in the small of the back, with a sensation as though he did not have strength enough to hold himself up; appetite still very poor; diarrhœa and abdominal pains entirely relieved; urine apparently normal; frequent sneezing was now present (a condition which was very marked before when he attempted to discontinue the use of opium); pulse 60; temperature $99\frac{1}{3}$° F. ℞. Same.

18th. During the night had five hours' refreshing sleep. The frequency and severity of the chilly sensations in the back were greatly diminished. ℞. Same.

19th. The pains in the hands and arms had all disappeared, and those in the lower extremities were greatly ameliorated. Slight pains still continued in the small of the back, and the sensation as though water was flowing down the spinal column appeared only at long intervals. The stools and urine were normal.

20th. Had not suffered from any pains or chills in the previous twenty-four hours, and slept seven hours during the night. Discontinued all medicine.

21st. Still improving; had a dull headache, but it passed away during the night. Sleep was quiet and refreshing.

22d. Said he felt well in all respects, except a little physical weakness; that since the delirium all desire and craving for Opium had passed away. Pulse 74; temperature, $98\frac{3}{4}$° F.

On the 25th was troubled with a return of a few slight chills; a dull, heavy feeling on the crown of the head; bad taste in the mouth, and restlessness during the previous night. ℞. Tarantula[20], which, he said, removed all abnormal conditions within an hour after taking the first dose.

27th. At the request of his wife he was discharged.

Case number two was treated at about the same time and in the same way, to wit, discontinuing all Opium at once, admin-

istering Tarantula[30], and with the same results; that is, preventing any marked disturbance of the nervous or physical systems by its disuse; removing at once all desire for Opium, and antidoting immediately all secondary conditions.

ARTICLE X.

LECTURE TO STUDENTS ON

THE ELECTRICAL TREATMENT OF THE MOST COMMON FORMS OF PARALYSIS.

(Delivered in the Spring Course of 1879, at the New York Homœopathic Hospital.)

BY JOHN BUTLER, M.D.

(Reported by Dr. H. C. Blauvelt.)

GENTLEMEN: To-day we will take up a subject which is one of the most important in electro-therapeutics. I mean the treatment of paralysis. Now what do we understand by the term paralysis? Paralysis as generally understood, means merely a loss of power of a muscle or set of muscles. It is said to be total, entire, or complete when there is no ability of the part affected to respond to the dictates of the will, and partial or incomplete (some authorities call this latter condition paresis) when there is some power of motion; but where the part responds but feebly to the will, I use the term paralysis, then, as an equivalent word for loss of power in any muscle or set of muscles. My friend and colleague, Professor Lilienthal, having been all through the detail of the pathology and etiology of this subject during the winter course, and presuming that you are therefore thoroughly acquainted with all the facts pertaining thereto, I will only touch upon them now, as far as is necessary, to explain the electrical treatment. Paralyses have been classified according to their location, cause, or location of their cause, and divided into constitutional, central, peripheral, and reflex. Constitutional paralysis is that form which occurs after a debilitating disease, such as typhoid fever, small-pox, diphtheria, etc. To this division also belong pa-

ralyses produced by poisons introduced into the system, as lead, phosphorus, etc.; also hysterical paralyses. Central paralyses are those in which the integrity of one of the nerve-centres, either of the brain or spinal cord, is interfered with, as by cerebral or spinal hæmorrhage, a tumor growing in the vertebral canal, fractures of a portion of the spine, inflammatory action of the spinal cord or of the brain, embolism, thrombosis, etc. Peripheral paralysis is caused by the nerve supplying a muscle or set of muscles being interfered with in some part of its course; the lesion may be traumatic or not. A common cause is a wound, the effect of cold, inflammation of the nerve, continued pressure on the nerve; for instance, paralysis of the arm often results from the pressure of a crutch in the axilla. Then there are reflex paralyses, which are produced by irritation in some part of the body remote from the muscle paralyzed, as by worms in the intestinal canal, uterine, nephritic, urethral and other diseases, the irritation of teething, etc.

Before going any further with this subject, we shall first ascertain whether electricity will cause paralysis, and then, whether it will cure it. Now will it cause paralysis? There is abundant proof that it will, and if any of you are not fully satisfied on this point, you can easily try it for yourselves, in a way I shall show you presently. We know that lightning discharges have over and over again produced paralysis, but it is not necessary to carry our experiments to that extent, for the simple discharge of Leyden jars or Rumkorff's coils have frequently produced it. Now this paralysis may be temporary and evanescent, scarcely existing longer than the exciting cause, or it may be permanent. To produce a temporary paralysis we will take an ordinary induction coil and make it act on the motor point of a muscle that is not often used, say the first dorsal interosseous muscle of the hand. The result will be this: Here is the motor point of this muscle between the first and second metacarpal bones. You see it marked here on this diagram. Now if I hold one pole in the hand,

and apply the other pole on the motor point of the first dorsal interosseous muscle so; the result will be that I make this muscle contract every time I close the circuit. If I keep on with the experiment, the contraction will become more and more feeble, until finally the muscle will cease to contract to the stimulus of the current, or even to the will. You see the contraction becomes more and more feeble. Presently it will get to such a condition that it will not only cease to contract under the influence of the current, but will also refuse obedience to the will. (The lecturer then applied the poles on a student and demonstrated the fact.) That is one of the many proofs that electricity will cause paralysis. The fact that electricity would cause paralysis has been known for a long time. Here is what Duchenne says on the subject:

"There is no need of experimental medicine to inform us that in its therapeutic aspect localized faradization is a two-edged weapon. Empirical observations very soon convinced me that localized faradization, if applied to a muscle or nerve for too long a time, or in too full a dose, may increase or even produce paralysis or atrophy instead of curing either. It was such clinical observations that led me to lay down the precept that muscular faradization must be moderate in degree, and that neither the whole application, nor the application to any single muscle should be unduly prolonged. It is indeed shown both by clinical observation and experiment that neuro-paralytic hyperæmia is a morbid state that is seen in atrophic paralysis, consecutive to lesions of the cerebro-spinal centres or of the nerve-trunks. It is rational to conclude that any agency which increased the neuro-paralytic hyperæmia would aggravate the pathological state, but this is precisely the opposite of what I have witnessed, when by the aid of faradization I have cured the cases of atrophic paralysis that have been brought to me in such a condition. Under the influence of the treatment I have seen the color of the skin and the nutrition of the paralyzed limb return in a short time to their normal state."

Now how do we treat paralyses with the electric current?

It is necessary to understand what kinds can be cured by it, and what kinds cannot. Therefore we will have to discriminate between the different kinds of paralyses. For example, say you should meet with a case, and electricity is the remedy that first comes to your mind, but you are not sure that it is a case that can be cured by electricity, how are you to be certain in the matter? There is a rule, it is this. You can be certain of always *helping* your patient if you find the following condition present: If you find in any case that the electrical contractility, or power of contraction of the muscles, or rather amount of contractility under a given amount of current is less than that of the corresponding healthy muscle on the opposite side of the body. Take for example the deltoid; if the contraction of the deltoid of the affected arm is less than that of the corresponding muscle on the other arm, then you have a case amenable to electrical treatment, and you will be sure to benefit the patient, provided the electricity is properly applied; but if the muscular contractility is equal to that of the corresponding healthy side, you will obtain no beneficial results from electricity, and it is useless to persist in trying it.

We will take up now a short consideration of hemiplegia. As you all know it is most often caused by cerebral hæmorrhage; blood is effused owing to rupture of a bloodvessel in the brain, and pressure is caused by it on the cerebral substance itself. The patient is suddenly attacked, and either falls down, becoming unconscious, or in lighter cases, may awake some morning and find one side of the face, and one side of the body, paralyzed.

Now in such a case will it be advisable to use electricity? I say no, not at first; better wait two or three weeks until all evidences of inflammatory action have had time to subside and the process of absorption has commenced. Some authorities are opposed to this principle. Althaus recommends early galvanization of the head at the side opposite to the paralysis, in order to promote absorption of the clot. Others think it ab-

solutely necessary to postpone all electrical treatment until the danger of cerebral fever has passed off. It is best not to commence the application until all inflammatory action has subsided, and there is some chance for the absorption to go on. (Duchenne says that in severe cases five or six months ought to elapse before commencing treatment.) When you do decide to commence, first of all you must examine the condition of the parts; if you find that there is no atrophy, but that the muscles are a little more soft and flabby than the opposite side, and the patient cannot move or use the affected part, your prospects of benefiting the patient are in the inverse proportion to the amount of the electro-contractility of the muscles. You will often find that the muscles will not contract with the same amount of force as the corresponding ones on the healthy side. In such a case you can do much to restore the contractile power of the muscles; and the ultimate probability is, that although the patient will not become entirely well, he will again have considerable use of the paralyzed parts. That is in a partial and recent case, but suppose it is an old-standing and severe case. You know the general appearance that such a case presents. The arm is drawn up and completely flexed, the hand is held tightly to the side, and the fingers clawed; the muscles are rigid, and if you pull the hand or limb down, it is only done with great difficulty, and as soon as you let go it immediately returns to its former position. Now in this condition of rigid contraction, electricity is absolutely of not the slightest use. The best authorities are agreed on this point. But take a case which is of long duration, and has not that contraction of the muscles, and where the faradic contractility is diminished, you can be certain of producing a great deal of good. It is an encouraging fact that long-standing cases of *this* kind can often be treated with better results than recent ones. You would use the current of course interrupted. The best method of interrupting the current is by means of a rheotome, and the most convenient form of rheotome is one attached to the handle of the electrode, with a thumb depressor, so that by pressing upon or releasing it the current is in-

terrupted or allowed to flow. Let the current flow a second, then rest a second, so—click—click, and so on. The probability is, as I say, that you will do the patient a great deal of good, but in the majority of cases like this, return to *absolute* health is rare. Hammond says: "No matter how light the attack may have been, nor how rapid the improvement, the patient who has had cerebral hæmorrhage is never mentally or physically the same as he was before. If the seizure has not been severe he may advance so far towards a complete cure as to evince very little disorder of his mind or body. But close observation shows that he is not entirely restored, and though he may do very well for light intellectual and physical exertion, severe labor of either kind is beyond his powers, and no one is more sensible of this fact than himself."

Another form of central paralysis is paraplegia. You all know that this is a paralysis of both lower extremities, and is produced by a lesion of the spinal cord. That lesion may be a simple hyperæmia or anæmia of the cord, or any cause that temporarily interferes with the functions of the cord. It may be caused by fracture of the spine, hæmorrhage, or by a tumor in the spinal canal. Where it is due to the first causes, anæmia or hyperæmia, you will generally find that the paralysis is not complete. General debility is well marked. It is difficult for the patient to maintain an erect position or even to move. In such a case electricity will cure the condition, and sometimes a cure is effected without applying an electrode to the limbs at all, but simply by galvanizing the diseased portion of the spinal cord. A common form of paralysis is that known as infantile, which is generally due to inflammatory softening of the anterior portion of the gray matter of the spinal substance itself. I have treated a great many cases of this form of paralysis, and I do not recall an exception to their being cured. They need skill, patience, and long and steady perseverance. In all but very recent cases it is well to treat the affected muscles by faradization, besides using the galvanic current on the spine, on the part where the disease is supposed to exist. When the lesion is caused by fracture, or a tumor in the vertebral

canal, it is needless to say that electrization will be of no service towards bringing about a cure; but in the case of a slowly growing tumor, electrization of the affected muscles will often give much temporary improvement. Peripheral paralysis—that is, a paralysis produced, as I explained to you, either by injury or by a solution of continuity of a nerve between its origin and the part to which it is distributed, or by disease of the nerve itself. Now suppose we have a case of facial paralysis to deal with, how do we know whether the lesion is peripheral or central? Take for example a case of Bell's palsy, which is paralysis of the facial nerve (of this nerve marked here on the diagram), how can we tell whether paralysis of that nerve is of peripheral origin, or is due to apoplexy or hemiplegia? We want to ascertain that fact, for it is very important, as regards the prognosis, whether we diagnose the cause of the disease correctly or not. It is a very easy matter to find out—one of the simplest in the practice of medicine. Suppose that the disease has existed for two weeks. You will first apply the faradic current to ascertain if the electro-muscular contractility is perfect, and is equal to the opposite side; if it is, then you may set it down as a positive fact that the cause is of central origin; but if it is not, and there is little or no contraction produced by the faradic current, then you have a case of Bell's or peripheral paralysis, and the lesion is probably located in the stylo-mastoid foramen or just after the exit of the nerve from that foramen. Can we do any good by treating a case in which all the faradic contractility is lost? Yes. Although it may not respond to the faradic current, if we use the interrupted galvanic current, the contractility will often be found to be even greater than on the opposite side. It is a singular fact, that when a case of Bell's paralysis has existed for two weeks there is always loss of muscular contraction to the faradic current, and often increased to the galvanic. What is the prospect? Well, unless it is caused by a pressure of a tumor in the stylo-mastoid foramen, or by any pressure on the nerve that cannot be removed, or is due to some lesion that cannot be overcome, *e. g.*, caries of the temporal bone, we

would expect to cure the case. The length of time that it will take to complete a cure depends on the length of time the disease has existed; it is always proportional. We commence with the galvanic current and use it every day, better still twice a day if possible. Make regular interruptions of the current, about forty beats to the minute, making the muscular contractions intermittent. You should not apply the current to several muscles or a group of muscles at the same time, but place one electrode on the nerve at its exit from the foramen, and the other electrode at the motor point of each muscle, that is to say, where the muscle is supplied by the nerve, or one pole on the motor point and the other on the middle of the belly of the muscle. You should be assiduous in the application, and continue it for weeks, until some day you will be rewarded by noticing that the muscles will contract somewhat under the faradic current, and respond slightly to the will. Then you can lay aside the galvanic current and use the faradic, under which the case will get well, but it takes a long time and the most attentive and careful treatment.

A common cause of this trouble is cold, a stroke of wind (as it is called by the French) on the side of the face. A person has been out in a snowstorm and somewhat exposed; at first the side of the face feels numb, and on awaking the next morning he finds it impossible to close the eye on that side; he cannot whistle or use the buccinator muscle; when he smiles but one side of the face moves; in other words, one side of the face is paralyzed. It is common for a patient who finds his face all drawn to one side, to suppose that the side of the face towards which the mouth is drawn is the affected side, and that the trouble is due to what he calls a spasm.

An important question that arises is, how are we going to treat these cases? What is the detail of the mode of proceeding? In simple medicinal treatment, where we prescribe the different medicines that have been lectured upon here, it is an easy matter, after you have selected the proper remedy, to have your treatment carried out, because they are all administered in about the same way; but, in the case of electrical

treatment, we have not only to prescribe, but also to apply the electricity. I will say, again, that it is not the electricity itself that cures, but electrization and the manner in which it is performed. Suppose I have a patient come to me with Bell's paralysis, and I decide to apply electricity. It is necessary for me to treat not only the facial nerve itself, but also the muscles that are supplied by that nerve. The amount of contraction produced by the closure of the cathode, or negative pole, is greater under the same amount of current than that produced by the anode, or positive pole. Therefore, if we use the galvanic current, we must, as I just said, apply one electrode at the exit of the facial nerve. It is best to use an electrode like this (shows instrument), which is small enough to be pressed in, in front of and below the tragus of the ear. The other electrode should be applied to each muscle individually, and not only to the muscles, but to the motor points of those muscles; that is to say, where the nerve enters the muscle; and the current should only be of such a strength as to produce visible contraction.

For example, we will commence at the topmost muscle supplied by the nerve under consideration, the corrugator supercilii. The motor point of this muscle is just above the superciliary ridge, and a little external to the centre of that ridge. We often want to act on this muscle. The motor point of the compressor nasi muscle is at the inner canthus of the eye, and a little below it, more on the nose than on the canthus. That of the orbicularis palpebrarum is just here, on the outer part of the malar bone. The orbicularis oris has its motor point right here, half an inch below the angle of the mouth; and so I might go on and deliver a whole lecture on the muscles supplied by this nerve alone. It is impossible to teach you all these points in a lecture, so we will reserve what I have to say about them until another time.

My object now is simply to show you how absolutely necessary it is that you should know these points before you can expect to apply electricity with success. Now suppose I apply one electrode here at the point of exit of the nerve, and simply

place the other on the centre of the cheek. It is true that I get partial contraction of all the muscles, but not the vigorous contraction that I can produce when I apply the electrodes carefully to each motor point; consequently the paralysis becomes no better, or very little better, under such treatment. In the same manner we treat other forms of paralysis, such as hemiplegia, although this form is of central origin. In hemiplegia the prognosis in severe cases, as I said, is not always favorable, especially where contraction is present. It is important that you should state this fact to the patient in the first place. Tell him that it is necessary to continue the treatment for a long time, and that applications should be made frequently. It will take an hour, or at least a half hour every day. As to the ultimate results you will do some good; how much you cannot tell at first, but an entire cure is often impossible. A few patients at first will consent to undergo the severe and troublesome ordeal, and get tired of it before any good can be accomplished, and after awhile the physician is dismissed. (Want of perseverance on the part of the patient is one of the great difficulties in the treatment of these cases.) Others will refuse the tedious treatment from the very first.

Now say we have to commence the treatment of a case of hemiplegia. If the face is involved, treat the face; from here continue the application downwards until all the branches of the brachial plexus are acted upon. Then continue down the side until you have acted upon each nerve and muscle separately, the motor point of which you must know, and which we will allude to again. It is a tiresome proceeding, and one which taxes the endurance of the patient as well as the physician. It is generally owing to the non-assiduous or ignorant and careless treatment that we have such bad results, and so many cases remain totally paralyzed.

Hysterical Paralysis.—If I wanted to demonstrate an instance of a brilliant cure by electricity, I would choose a case of this form of paralysis to illustrate it—say paralysis of the vocal cords. It is astonishing how, even after one application, where the voice has been lost for weeks, and no ability of

phonation remains, the voice will return to its normal condition. I have seen this occur frequently under the faradic current, and that from simply passing it through the larynx itself from side to side, by placing the poles on the outside of the neck. The larynx is best electrized by local applications from the pharynx by using the laryngoscope, and applying the poles to the muscles separately; but it can be electrized, and sometimes successfully, by using the electrodes externally. The latter method is especially desirable when you have a nervous woman suffering from hysteria to deal with. The chances are that in some cases you will not be obliged to make a second application, although it is generally well to apply it several times.

Lead paralysis is another form of constitutional paralysis. Now suppose I have a case of paralysis come to me, and the patient is a painter by trade, how will I know whether the disease is due to lead-poisoning or to some other cause? That is an important point, and should be ascertained in the beginning. I will tell you. In all cases of lead paralysis, the supinator and extensor muscles of the forearm are the ones devoid of power; the flexors and pronators are never affected; but, as the paralysis progresses, the deltoid becomes involved, and sometimes the biceps. The rule then, is, that when the affection attacks the forearm, the supinators and extensors are the paralyzed muscles, while the rest remain in their normal condition. This is an invariable rule, and you may set it down that, when you have a case of paralysis of this kind, that it is caused by lead-poisoning. Now what is the prognosis? You will find that it is just the same as in Bell's paralysis; that is, the faradic contractility is diminished from the beginning, and, by the time the physician is called to treat the case, it is generally entirely lost. You should first try to rid the system of the poison by internal treatment. Commence the application of electricity with the galvanic current until the muscles begin to respond to the faradic, then use this latter. The treatment must be assiduous, and, if the patient is not willing to undergo all the requirements, you had better dismiss him at once. In

these cases we commence with the galvanic current, slowly interrupted, of just sufficient strength to cause the muscle acted upon to visibly contract, the pause between each "make" of the current being sufficiently long to allow the muscle to relax into the state of repose in which it was before it was made to contract. As a general rule two to four makes and breaks in the current per second are sufficient. Do not fatigue the weakened muscles with unduly prolonged seances. As soon as a muscle exhibits symptoms of becoming wearied the treatment must be discontinued, or otherwise we may do the patient much injury.

The treatment should be repeated daily, and continued until we find that the muscles show some response to the action of the faradic current. When this takes place we continue the treatment with this form of current, observing the same rules as regards the pause and frequency of the interruptions as just laid down in reference to the galvanic; and in using this current we must be careful not to cause pain. If, after having commenced to employ on a case, we find that the seances are painful with currents that are too feeble to make visible contraction, we must go back to the use of the galvanic current, for a few days or weeks, until the faradic contractility is better established.

In the treatment of all cases of paralysis, for the purpose of regulating and accurately observing the dose of electricity administered, it is more than advisable to have an easily adjusted rheostat, and a reliable galvanometer included in the circuit. By a reliable galvanometer I mean one which indicates the absolute amount of current flowing, for although we may not always be able to prescribe the exactly required dose and no more or less, still it is well in each instance to note carefully the amount that has been administered, and to preserve the record for future reference, and perhaps future guidance.

How to use these instruments I have already explained to you in preceding lectures.

Gleanings from Foreign Journals.

ARTICLE IV.

A CASE OF HYSTERICAL HEMIANÆSTHESIA.

BY H. RADCLIFFE CROCKER, M.D.

(From British Medical Journal.)

L. P., aged nineteen, a tall, well-made, intelligent girl, was brought by her mother to the East London Hospital for Women and Children, on October 23d, 1878, complaining that she frequently fainted, and had much pain in the right ovarian region. The mother said she had fainted four times on the 18th and twice on the 21st; she was generally drowsy, but not especially after the attacks, and did not know she had had an attack unless told of it. On the night previous, while sitting in a chair, she said, "Oh, mother, I feel so queer," and fell forwards quite insensible, and remained so five or six minutes, but was not drowsy afterwards. She menstruated regularly but with a good deal of pain, and the catamenia for the last period had not quite ceased. The mother did not consider her hysterical, nor was her manner suggestive of that condition. On questioning the girl as to any difference of sensation, she denied anything of the kind; but when pricked on the back of the right hand with a needle, to her surprise she could not feel it, and the needle could be passed deeply in without the smallest sign of pain, and on withdrawal no bleeding ensued. The slightest prick on the palmar surface made her draw her hand away immediately with an exclamation. Further investigation showed that the anæsthesia was limited to the right side in the following situations: The extensor surface of the arms, the outer part of the legs, and the right side of the face, except in the eyelid, ear, and forehead; in fact, over the area of distribution of the temporal branch of the fifth some sensation was retained, but less than on the opposite side. There was marked hyperæsthesia over the right ovarian region. On the left side, sensation was quite normal; she could see and distinguish colors equally well

with both eyes. Holding the finger in front on the face, and desiring her to fix her eyes upon it, and passing the other hand across the eyes, sent her to sleep with some difficulty, and sometimes failed from the patient laughing; but it was found that closing the eyes and pressing gently upon them with the thumb, sent her to sleep at once, from which a noise or pricking the left hand or the palm of the right hand would immediately wake her; pricking the back of the right hand had no effect. No mesmeric phenomena, except this apparently normal sleep, could be induced at that time.

A few small blisters over the right ovarian region, and the administration of Bromide of potassium, soon removed the hyperæsthesia over the ovary, but no alteration of the other phenomena of sensation was induced.

The experiments on sensibility were in three series. In the first the nature of the materials and the object of their application were concealed as much as possible. In the second the patient was aware of the effect expected, and saw what was going to be applied. In the third, although she was aware of the object of the applications, sensibility was tested during sleep.

They were spread over a period of nearly five months; between the second and third there was an interval of two months.

A gold coin was bandaged on for a quarter of an hour without any effect. A thin piece of wood, a disk of Betts's capsule metal, a small magnet, wafers, and the constant current up to twenty-three cells of a Weiss's battery, were without effect. After half a crown had been put on for five minutes, the patient knowing what it was, some return of sensibility occurred.

The first of the next series of experiments was carried on under the superintendence of my colleague, Dr. Donkin, who saw her with Mr. Hutton, the clinical assistant, during my absence. After saying that the previous applications had been ineffectual from not being on long enough, two half sovereigns were fastened on the forearm for half an hour; on then re-

moving the bandage, gentle pinching, or even stroking, was felt clearly, though not so acutely as on the opposite side; and while the eyes were closed, the patient touched with the other hand the exact spot which had been stroked. The following week I repeated this experiment, bandaging on two gold coins for three-quarters of an hour; but the back of the hand was still anæsthetic. I did not test over the site of application, which was, as subsequent events showed, an important omission, so that the failure may have been only apparent; for on another occasion, when the experiment was repeated in an exactly similar way for one hour, sensation was restored, though less completely than on the left side, from one inch below the part on which the coins were placed upwards over the whole arm and face, but not to the hand; the site of the coins was the most sensitive part; below the knee, on the outer side, she could just feel something on being pricked, but was sensitive above.

On another occasion, without any remark being made, a surface thermometer was applied for fifteen minutes on the anæsthetic arm, and the temperature was found to be 93.6°, but sensation was completely restored over the part to which the thermometer had been applied, and partially over the rest of the limb. It was now predicted in the hearing of the patient that, when the instrument was applied to the sound side, sensation would be lost. The temperature of this side was 94.6°. Sensation was completely abolished over the place of application, and partially lost over the rest of the forearm. Two gold and silver medals were now bandaged alternately on the flexor surface of the left forearm, one of the gold being on the anæsthetic part where the thermometer had been applied; and it was remarked to the bystanders that, where gold was placed, sensation would return; where silver, there would be anæsthesia. In sixteen minutes the effects were tested with the patient's eyes closed, and the prediction was fulfilled, the influence of each medal extending a little beyond its site. The top and bottom medals produced a more marked effect than the middle ones, which had been placed close

together. Half an hour later sensation was on the left side almost restored, the anæsthesia being nearly complete on the right, except on the place where the thermometer had been.

After this the patient ceased attendance for two months. When she came again, she stated that she felt better in her general health, but there was still pain in the ovarian regions at periods which recurred every three weeks. The sensational phenomena were unaltered. On inducing sleep by pressing the thumbs on the eyeballs and stroking the face, no consciousness was exhibited when a needle was thrust into the back of the right hand, but she awoke with a start when the left was pricked.

Three gold coins were now tied on the right forearm for a few minutes, and sleep being again induced, there was no effect on pricking the left arm, but she awoke immediately on pricking the right.

Before the coins were applied, there was some sensation on the right side of the face, but less than on the left; after their application this was reversed. On another visit, the patient having been blindfolded, a florin placed on a bit of paper was pressed for a moment on the right arm; and as the bandage was put on the coin was removed, and the paper only left; after fifteen minutes sensibility was restored, but with no alteration on the left side. A similar procedure was now adopted with the left arm, the patient hearing that sensation would be lost; and it was, but only over the part where the paper had been. Sleep having been induced, a needle could be thrust into the site of the paper without any sign of sensation, but a slight prick a little below this part immediately awoke her.

On the last occasion the right arm was found to have some feeling in it, so the left was chosen for experiment; and it was predicted that sensation could be mesmerized out of it. Her arm was stroked with the hand from above down for two or three minutes; and on testing sensation five minutes later, the limb was totally anæsthetic. By stroking it upwards sensation was restored, while the right arm was quite anæsthetic after a few strokes downwards. In reply to a question

the patient said she felt sensation going, "the arm getting numb." During sleep she could be made to perform any acts she was desired to do; *e. g.*, walk round the room, fetch anything, etc.; the eyes were closed, and she was evidently asleep, staggering as she walked, and feeling her way; and when standing still would have sunk down on the floor if not supported. While in this condition she was told to thrust a needle into the right arm. She did so without any sign of sensation; but on doing it on the left side awoke with a start directly.

Remarks.—The above phenomena appear to me explicable only on two hypotheses: either that the patient pretended to experience these variations of sensibility, and to be asleep when she was not so; or that the effect of the applications was due to the mental impression they induced and not to any physical effect upon the skin; for is it conceivable otherwise that such diverse applications as gold and silver, glass and paper, and a few gentle strokes of the hand, should all prove to be equally effectual?

With regard to the hypothesis that she was shamming, the objection is equally applicable to the other recorded cases, but no one who has really witnessed them ever entertains such an idea. In this case the experiments were always carried on in the presence of witnesses, among whom I may mention particularly my colleagues, Drs. Donkin and Warner; but no one for a moment doubted the reality of the phenomena, nor of her being really asleep. The partial distribution of anæsthesia is a very unlikely phenomenon to be assumed. It is noticeable that silver had on one occasion some effect in restoring sensation, before it had been expressly stated in the presence of the patient what result was expected; but this was only after previous experiments had been made with other substances; and since sensation was of course tested after each, the patient would soon learn what was anticipated, and subsequently, in fulfilment of a prediction, the same metal had a

directly contrary effect, I think this gradually acquired knowledge of what to expect, soon vitiates attempts to conceal the object of the applications. Take, for example, the case recently published by Dr. Cockle. Four metals had been applied, without any result; and then, three days later, when gold was applied, sensation was restored. No doubt the believers in metallo-therapeutics would say that this was because gold was the metal to which the patient was sensitive. But can it be proved that the patient had not learned the object for which the metals were being applied? And how will metallo-therapists explain the opposite effects of the same metal at different times in my case? In the case of the thermometer, the patient had no reason, except the metallic appearance and the experience gained by previous applications, to think that any effect or sensation was looked for. It is observable, also, that no transference of the phenomena was obtained, except when either it was foretold or when applications were directly made to the sound side. The curious localization of the results in some of the experiments to the part of the skin covered by the substance employed, and a short distance beyond only, is noteworthy, and suggests the necessity of always testing over the part covered by the applications. In Westphal's case, Dr. Hughes Bennett's, and my own, all strongly point to a mental impression, however induced, being the real factor, at all events, in these cases, in the production of the phenomena; and although at present some cases are not so plainly ascribable to this, I am strongly inclined to believe that further carefully conducted experiments will show that it is in this direction that we must seek for their explanation.

Article V.

CASE OF HYSTERICAL HEMIANÆSTHESIA.

UNDER THE CARE OF DR. COCKLE.

This case presents the following features of interest in an otological point of view. The patient (female, married, aged twenty-seven years) was admitted to the Royal Free Hospital,

London, on October 22d, 1878, suffering from left hysterical hemianæsthesia, cutaneous hyperæsthesia along the spine, and affection of the special sense on the left side. A few days after admission the hearing for the watch was, left ear, one inch; right ear, eight inches. Normal hearing distance not stated.

The cutaneous anæsthesia was unaffected by plates of copper, zinc, iron, or lead, but was partly relieved by gold. Subsequently the cutaneous anæsthesia was much relieved by the continuous current. The anæsthesia of the special senses continued uninfluenced.

December 5th. Hearing watch, left ear, one and a quarter inches; right ear, eight inches. The continuous current was then applied over both parotid glands, commencing with four cells of a Leclanché battery, gradually increased to fifteen cells, and then diminished again to six cells. Total time of application four minutes. Afterwards hearing watch, left ear, five inches, and the other special senses were also much improved. Next morning hearing watch, left ear, two inches. Continuous current then applied almost daily to the face, with a steady gain of sensation, though after each application, the gain made during the use of the current was subsequently partly lost.

December 17th. Hearing watch, left ear, four inches, before the application of the current. Immediately as usual after the application of the current all the senses were much improved. Application of current discontinued.

January 3d. State of patient. Hyperæsthesia of back has entirely disappeared. Whole of left side again anæsthetic and analgesic. Hearing watch, left ear, three inches. The other special senses had also retrograded, but there was slight improvement since admission.—*British Medical Journal*, April, 1879.

Article VI.

TWO CASES OF NERVE-STRETCHING,

UNDER THE CARE OF MR. CHARLES HIGGENS, GUY'S HOSPITAL.

Case I.—Jeremiah D., aged sixty-two, was admitted on August 13th, 1875. The left eye had been excised two years previously, having been lost three years before that from a blow with a piece of iron. It had been painful for six weeks previous to excision. He had had neuralgic pain in the supra- and infraorbital regions ever since the eye had been removed. Of late the pain had become very severe.

August 17th. The supraorbital nerve was cut down upon and stretched, and a small fibrous mass, which, on examination, proved to be the pulley, with a portion of the tendon of the superior oblique muscle, was removed.

August 19th. The neuralgic pains had disappeared. In the parts supplied by the supraorbital nerve there was numbness, but not total loss of sensation. The pain was as severe as ever in the districts supplied by the infraorbital nerve.

August 23d. The infraorbital nerve was stretched.

October 20th. Sensation was found to be perfect over all the parts supplied by the nerves operated upon, excepting over a space close to the margin of the upper lip, which was quite numb. The neuralgic pain had entirely disappeared.

Case II.—(Reported by Mr. Morrison.)—James C., aged fifty-three, was admitted on October 21st, 1878. In March, 1877, he had been struck in the right eye by a piece of iron, and sight had been immediately lost. Six months later the damaged eyeball was removed. He soon recovered from the operation, and for some time remained in his usual good health.

About November, 1877, he began to suffer from paroxysms of severe pain over the right half of the scalp, in the area of distribution of the right supraorbital nerve. The pain seemed to start from the supraorbital notch, and shoot backwards thence between the ear and sagittal suture.

Previously to his admission as an in-patient he had been attending amongst the out-patients for ten or eleven months, but without appreciable benefit; and, during the last month or two, the attacks of neuralgia had been more severe than ever.

October 21*st*. An incision was made down upon the supra-orbital notch, and the nerve picked up and stretched by pulling it with forceps. The edges of the incision were then carefully brought together with five sutures.

October 24*th*. Sensation of the right half of the scalp was found to be impaired as far back as to a line drawn over the vertex from one ear to the other. There was no pain. The wound having healed perfectly, the sutures were removed.

November 2*d*. Tactile sensibility was returning. There had been no attack of neuralgia since the operation.

November 11*th*. He complained of occasional dull pain at the back of the orbit. There was a small hard swelling on the vertex, and he said this part felt as if he had been carrying a heavy load upon it. Tactile sensibility was normal in the region supplied by the stretched nerve. There was no neuralgia.

REMARKS.—Very severe neuralgia of some of the branches of the first division of the fifth nerve not unfrequently follows excision of the eyeball. It is very probably caused by implication of some of the branches of the nerve in the cicatrix of the conjunctiva, by the subsequent contraction of which they are kept more or less in a state of tension. Such being the case, it seems reasonable to suppose that traction upon the larger branches, as in nerve-stretching, may relieve the tension of the imprisoned fibres, and thus cure the neuralgia. At any rate, whatever explanation of the *modus operandi* may be offered in the above-cited cases, as well as in others which have fallen under Mr. Higgens's notice, the benefit produced by the operation has been immediate and most marked.—*British Medical Journal*, June 14th, p. 893.

THE AMERICAN JOURNAL

OF

ELECTROLOGY AND NEUROLOGY.

JOHN BUTLER, M.D., Editor.

VOL. I. NEW YORK, OCTOBER 1, 1879. No. 2.

Editorial.

IN putting the second number of our JOURNAL before our subscribers, we take the opportunity to thank the profession for the liberal support they have given our undertaking. We would feel inclined to now announce the JOURNAL as a positive success, were it not for the fact that we once saw such an announcement in the second number of a periodical which died after a very brief existence and is now almost forgotten. However, everything so far promises well; we have received several excellent articles; some of the most prominent specialists in the country have promised to become regular contributors; the advertising columns are patronized by the very best houses, as may be observed; and the subscriptions, although not pouring in, are coming in fairly. We wish to thank the editors of the various medical magazines who have sent us their good wishes, and have devoted so much of their valuable space to reviews of our paper. This warm reception was somewhat of a surprise, for the reason that we supposed that a large majority of the profession were rather indifferent to the subject of electrotherapy, which certainly was the case a few years ago, but we are glad to have *such* positive evidence that matters have improved in this respect, and that the number of those interested in electrology are largely on the increase. It is time that the profession in general should awaken to the importance of this subject. It is time that the elements of electro-therapy should form a part of the education of every physician. By this we do not wish to be understood to say that it is necessary that

every practitioner of medicine should be an expert electro-therapeutist; that is manifestly impossible, for no man in general practice could expect even in several years' practice to come in contact with a sufficient number of cases, requiring electrical treatment, to give him the necessary experience, and allow him to acquire that amount of tact and skill requisite to insure success. Furthermore, a physician doing a large family practice, even if it were possible that he should be possessed of the necessary skill, would not feel called upon to invest in the necessarily expensive instruments, and expensive materials that would be unused most of the time (and deteriorate as much by disuse as by use), for the sake of a few patients; nor could he pretend to be able to give an hour's or even half an hour's exclusive attention to each patient, nor is it necessary that he should, as long as there are a sufficient number of educated experts to whom he can refer cases for treatment. What we would say is this: that every physician ought to know sufficient electro-physics and electro-therapy, to enable him to recognize a case which will be more speedily benefited by electrical treatment than by any other remedy or remedies; and the country practitioner at least should know sufficient of the subject to enable him to treat emergencies and use electricity in those cases which require but little skill, such as the resuscitation of drowned persons or of new-born infants, post-partum hæmorrhage, inertia of the uterus during labor, etc., intelligently. The rudiments of electro-therapy should be taught in all our colleges. It should form part of the compulsory examination of our graduating classes; but the electrical treatment of most cases outside of those we have just mentioned require special knowledge, acquired skill, and experience; and so the *actual practice* of electro-therapy for the most part, and electro-surgery entirely, must be left in the hands of experts. In our larger cities we should have a *sufficient number* of these experts, who should be men of ability, of good education, mature experience, who have devoted some ten or twelve years of their lives to general practice, so as to be able to use sound judgment in forming a diagnosis or prog-

nosis; they should be thoroughly versed in electro-physics, which is the foundation of the science; should be quite conversant with all the known effects the different forms of electric current are capable of exerting on the healthy organism, and their influence in disease; should be skilled in the manipulation of the delicate instruments that their avocation requires, and should devote them exclusively to this avocation. For a correct knowledge of electro-physics and electro-surgery, a fair knowledge of chemistry and general surgery is essential, and it is needless to add that no one can treat the simplest case requiring the use of electricity without at least a correct idea of anatomy and physiology. So, then, an electro-therapeutist should be an anatomist, a physiologist, a chemist, a good diagnostician, a sound pathologist, and a surgeon; besides being skilled in the special department to which he devotes himself. There are numbers of such skilled specialists in the larger cities on the continent of Europe. These men are recognized as a necessity, and are liberally supported by the profession. In New York we have only *five or six* such men, whereas there should be at least five times the number, and there no doubt will be when the profession in general will take the trouble to become sufficiently conversant with the subject in question, and recognize the value of the services of skilled experts.

From what we can now see of the growing interest of medical men in this department of medicine, we venture to predict, that in less than ten years there will be in our city alone over fifty expert electro-therapeutists, and a proportionate number in our other large cities. The leading physicians have long recognized electro-therapy as a necessarily distinct special branch of medicine, as much so as ophthalmology or otology; the fact that we have in our midst, men who for years have devoted themselves *exclusively* to electro-therapy, shows this to be so. Therefore, when we speak of the "profession in general, *beginning* to take an interest in electrology," we neither refer to nor include men at the top of the profession, men who keep thoroughly informed of the progress of science; but we mean the majority of medical practitioners, busy men who live in a

little circle composed of themselves and their patients, and who neither attend society meetings nor keep themselves posted on the advancement of medical literature, and who are so indifferent to the introduction of anything new in medicine that they take it up very slowly. We cannot but rejoice to see evidences of these men beginning to set a positive value on electricity as a therapeutic agent.

There is no doubt that the advancement of electrical science outside of medicine has done much to call the attention of medical men to the fact that we had such a remedy in our hands as electricity, and no doubt when the telephone, the modern electric light, and the hundreds of other recent inventions were announced to the public through the daily press, each announcement caused many a physician to read up on the subject of electricity, and to find a remedy, to which before he had given little attention.

There is one great evil which acts as a huge stumbling-block in the way of the advancement of electro-therapy, and that is: *Electrical quackery.*

Electrical quacks are thus defined in a recent exchange: "Ne'er-do-wells who learn a smattering of electricity, obtain a battery, and apply the current without regard to one single physiological consideration." We accept the definition. Such quacks may be divided into three kinds.

1st. Unprincipled vagabonds, who without any college qualification or any knowledge whatever, protected by loose legislation, and presuming on the credulity of the public, impudently set out their signs "electro-magnetic physicians," flaunt their shameful circulars in the face of the too easily humbugged public; and dishonestly fill their pockets from those of their credulous victims, whom they relieve of none of their symptoms but a good deal of their cash.

2d. Legally qualified practitioners, who have fallen from grace, who have no love for their profession, no wish for the welfare of humanity, care nothing about the advancement of science, whose only aim in life is to make money no matter how, as long as they can do it and still appear respectable,

who use electrical machines to play with patients, and make a show of doing something. They select electricity for the purpose of practicing their deceptive art, because people are more easily humbugged by it than anything else. It is capable of evoking the function of each of the five senses, and it is very hard to persuade a patient that a remedy (?) he can see, hear, feel, smell, and taste has not some virtue in it, and the stronger it is the more virtue, as a matter of course. These men never take the trouble to learn anything of electricity as a science; why should they? They do just as much business without.

The third class is composed of young physicians, who with the very best intentions, mean to "go somewhat into electricity." They buy some of the textbooks, and learn just enough of what is therein contained, to confuse them; then purchase a few electrical instruments and go to work with them on their unfortunate patients. After experimenting for awhile and finding that they do not produce all the results they expect, come to the conclusion that electricity is not the remedy it is painted. Some even go so far as to say it is perfectly worthless and inert. They never once dream that their failures are entirely due to their own want of knowledge, skill, and experience. This class of men do more to retard the progress of electro-therapy than either of the others mentioned; their standing socially and professionally is good, and their intentions known to be excellent, hence their *ipse dixit* has some value with their confreres, who never think of charging their conclusions to their having started upon a wrong basis.

What about the patients?

If one throws a handful of sand from a fourth-story window into a leading thoroughfare, the chances are that some of the particles will fall on the head of a person who happens to be passing; and so once in awhile a cure is made through guess treatment; but, as might easily be supposed, almost always a patient, after weeks or months of what he calls perseverance, finds himself no better, condemns electricity in no measured terms, and says he "tried it" for so long faithfully, and it

did him no good. Such a patient is in no frame of mind to commence over again with an expert.

Some of our readers may think we draw these pictures from our imagination, or overdraw something founded on a little fact. No, indeed; we are barely hinting at matters that come under our notice very often indeed, of which we can furnish indubitable proof. But such things cannot much longer exist. Electro-therapy is now beginning to be taught in our colleges. Physicians, as we before remarked, are commencing to recognize the value of electricity and its true position in the Materia Medica; they are also beginning to find out that the practice of electro-therapy requires special knowledge, special skill, and experience. It is gradually being discovered that it will not do to order the patient to be *electrified* by the nurse or the cook, or by some well-meaning but ignorant friend of the patient, as was often done in bygone days, and that it is not electricity that cures, but electrization and the accuracy with which it is performed.

N. B.—This paper is not published in the interest of any individual, clique, school, or party, nor is it the mouthpiece of any society, but has been established purely in the cause of science. Its pages are open to all who will contribute anything new to the cause, and the editor will thank those of his brethren who will send any communication (whether in the shape of an original essay or exact notes of clinical cases) that will help to throw new light on the important subjects to which the paper is devoted.

All exchanges, books for review, electrical and other instruments for editorial notice, and communications of a professional nature should be sent to the editor, 102 East Twenty-second Street, New York.

Advertisements and all letters pertaining to the business part of the journal must be addressed to the publishers, Boericke & Tafel, 145 Grand Street, New York.

Our next number will probably contain a continuation of "How to Perform Electrolytic Operations," by the Editor. "The Uses of Electricity in Aural Affections," by Dr. H. C. Houghton, New York. "A New Theory of the Influence of the Sympathetic on the action of the Heart," by Dr. W. Y. Cowl. Reports of three autopsies by Dr. Carleton. "A New Theory of Seasickness," by Dr. E. P. Fowler. A clinical record of cases from various sources.

New Books and Instruments.

HEADACHES AND THEIR CONCOMITANT SYMPTOMS. JOHN C. KING, M.D., Chicago. W. A. Chatterton & Co.

A little monograph of about 275 pages, arranged in the style of *Bell on Diarrhœa;* first the materia medica, and following it the repertory analysis. The book is carefully compiled, and gives evidence of considerable work and research, which will be appreciated by the profession.

Larger pages, larger type, with the characteristic symptoms of each remedy printed in italics, would in our estimation have been a better arrangement, and would have enhanced the value of the work.

THE DOCTOR WOMAN: OR, HOW I WAS CURED BY A FEMALE PHYSICIAN. By AIKEN HEART, M.D. Illustrated by C. H. Goodman. Published by the American Observer Office, Detroit, Mich.

One of the most amusing satirical poems we have seen in a long time; evidently written by a physician and a man of genius, who has a keen appreciation of the ridiculous. The illustrations are about the most original absurdities one can imagine. A single glance at them will cure the very worst attack of "the blues." A good way of investing twenty-five cents. You can leave the book on your waiting-room table for patients to read. A patient will cheerfully wait for you as long as the book holds out. We know this to be a fact, for we tried it.

THE HOMŒOPATHIC JOURNAL OF OBSTETRICS AND DISEASES OF WOMEN AND CHILDREN. Edited by HENRY MINTON, A.M., M.D. Published by A. L. Chatterton, New York.

The first number of this quarterly has reached us. It is a newly gotten up magazine of 110 pages, and contains several original articles on the subjects of which it treats. We would like to have found more from the pen of the editor, whose experience in gynæcology and obstetrics places him in a position to impart much useful knowledge. We hope in future numbers the doctor will not be quite so reticent. The few lines he has written in the editorial columns on what he knows about kleptomania are quite to the point, and well worth the careful perusal of those interested in psychology. The only fault we have to find with the journal is the title; we would much rather see the "pathic" left out, and the whole ground (which belongs as much to Dr. Minton as to anybody else) covered.

The Sphygmophone. An invention of a method for making the movements of the pulse audible by the telephone. By Benjamin W. Richardson, M.D., F.R.S.*

We transcribe the description of this instrument, given in the *Medical Times and Gazette*, by the talented inventor. We have nothing to add except this,—that it is our impression, with a little development in details, it can, in time, be made a valuable aid in forming a diagnosis, and is quite likely to come into general use.

"While experimenting with the audiometer, it occurred to me that I might get a secondary or telephonic sound from the movements of the pulse at the wrist. I have effected this in a very simple manner by adding a microphone to a Pond's sphygmograph. I mount on a slip of talc, glass, wood, or ebonite a small plate of metal, such as platinum or a little bar of gas carbon. I place the slip in the sphygmograph, as if about to take a tracing of the pulse. I connect one terminal from a Leclanché's battery to the metal or carbon, and the second terminal from the cell to a terminal of the telephone. Then I connect the other terminal of the telephone with the metal rod of the sphygmograph which supports the slip. The instrument is now ready for use. It is placed on the pulse in the ordinary way, and is adjusted, with the writing needle thrown back, until a good pulsating movement of the needle is secured. When the movement is in full action, the needle is thrown over to touch the metal or carbon plate, which it traverses with each pulse-movement, and completes the connection between the telephone and the battery. The needle in passing over the plate causes a distinct series of sounds from the telephone, which correspond with the movements of the pulse. When all is nearly adjusted the sounds heard are three in number, one long sound and two short, corresponding to the systolic push, the arterial recoil, and the valvular check. The sounds are singular, as resembling the two words, 'bother it.' The sounds can be made very loud by increasing the battery power.

"This little instrument is not a permanent recorder of the pulse like the sphygmograph, but it may be made very useful in class, for illustrating to a large number of students at one time the movements of the natural pulse and the variations which occur in disease. I call the invention the sphygmophone.

"*Additional Notes.*—May 26th, 1879. On the whole the carbon plate answers best, and for all ordinary purposes two Leclanché's cells are sufficient. From them the sounds produced are audible a distance of forty feet. By extension of the telephone wires the observations may be made in a room at a distance from that which

* Read before the Royal Society on May 14th, 1879, and with additional notes.

contains the person whose pulse is yielding the movements that produce the sounds.

"I have been able, since the communication relating to the sphygmophone was laid before the Royal Society, to make some new observations with it in cases of disease, and to compare the sounds it causes with the heart-sounds as they are heard through the stethoscope. I have also been able to get the telephonic expression derived from the cardiac pulsations. In a case of regurgitation the sounds on the sphygmophone, taken from the movements of the radial pulse, were very significantly marked. The first sound was short, the second was rather prolonged, the third was divided into two very short and sharp sounds, the last of the two running almost into the first sound without a pause. I suspected, from this, aortic deficiency with mitral obstruction, and the stethoscope confirmed this diagnosis.

"In the case of a patient who has no physical evidence of structural change of the heart, but who is subject to severe attacks of dyspeptic palpitation, an attack of palpitation came on while she was under examination with the sphygmophone. The sound now produced was of the most singular kind. It resembled precisely the rotatory motion of a large wheel, so that when I shut my eyes I could not believe that I did not hear the motion of a wheel or grinding-stone. Looking afterwards at the needle, it was seen to be making the usual movements as far as I could discern, but with great rapidity, yet I could not distinguish the three usual sounds from the telephone, nor aught except the quick rotatory whirr. When I held the telephone close to my ear the whirr was so loud and so perfectly like a wheel it made me feel giddy and nauseated, as if I myself were turning round. The palpitation, which lasted four minutes, stopped suddenly, and after a few hesitant strokes the usual natural pulse-rhythm was resumed.

"When a person who is being examined with the sphygmophone laughs, the pulse-beat is soon quickened, and the sounds produced are sometimes almost like an echo of the laugh itself. I notice also that with quick action of the pulse, when the beats are over ninety a minute, there is sometimes, together with the ordinary rhythmic sounds, a singular wavelike continuous murmur, resembling that which is heard when a shell is held to the ear. I am not sure as yet as to the cause of this murmur; it may be from friction of the blood on the walls of the artery; it may be from friction of the blood itself; it may be a wave produced from the acts of respiration.

"The sphygmophone will, I think, be found very useful for detecting minute and obscure pulsations in different parts of the body. It

also indicates very quickly the action of alcohol and other medicinal agents on the pulse.

"In applying the sphygmophone to persons who have intermittent pulse and who are timid, it is judicious to reduce the volume of sound; the intervals of intermittency and the renewal of beat being singularly unpleasant phenomena when they are brought out in too pronounced a form. In such cases the operator may either reduce the battery power or increase the resistance in some part of the circuit, and so bring the sound down to a whisper, to which he can listen by applying the telephone to the ear as if it were a stethoscope. In the consulting-room this is the best plan to adopt; it answers the purpose, and it does not disturb the mind, and thereby the circulation, of the patient."

A NEW RHEOSTAT. By JOHN BUTLER, M.D.

Outside of a specialist's office a rheostat is so seldom seen, that a few words describing its uses may not be out of place here. Rheostat is the name given to an instrument used for measuring resistances. The term also applies to any contrivance by which additional resistances can be introduced into an already existing circuit, so as to regulate the flow of current and keep it at the point desired. In electro-therapy when we speak of a rheostat we always allude to the latter instrument. To illustrate the mode of using it: Suppose we are engaged in transmitting a current through any part of the body; the sponges are *in situ* and the needle of the galvanometer points to 5°, indicating that a current of $\frac{5}{1000}$ths of a veber of current per second is being transmitted. But this dose is too great; we only want to administer $\frac{4}{1000}$ths; therefore we introduce resistances into the circuit until the needle swings back to 4°, or the figure on the galvanometer that indicates that the desired amount of current is being transmitted.

The great expense of the large coils of German silver wire used in Brenner's & Wheatstone's rheostats led to the substitution of the water moderator, which for awhile was in very general use among electro-therapeutists.

The unreliability as well as the inaccuracy of the latter instrument (owing to polarization rapidly taking place at the parts used to make contact with the water, and to the instrument itself being gradually consumed by oxidization), induced me to experiment with a variety of substances, with a view of making a rheostat which should be at once cheap, accurate, reliable, and easily adjusted. The instrument below described combines these qualities in a remarkable degree.

It consists of a plate of non-conducting material, on which is

placed, either on the surface or in a groove, a film of plumbago or other suitable resisting material. One end of this resistant is connected with the battery, and the circuit is completed through a movable key, one end of which is on the resistant, so that by changing the distance of the key from the extremity of the resistant joined to the wire from the battery, the amount of resistance is determined at pleasure.

In the accompanying drawings, Fig. 1 is a plan of the rheostat, Fig. 2 is a section of the same on line x x, and Fig. 3 shows a modified form.

Similar letters of reference indicate corresponding parts.

Referring to the drawings, A represents the bed-plate, supported on legs, B. It is made of hard rubber, slate, marble, glass, or *any other suitable non-conducting material.* In the upper surface of this table is a segmental groove, a, having at one end a slotted screw or stud, b, passed through the plate and joined underneath to a metal strip, c, the other end whereof is connected with the under end of the binding-post, d, to which the wire, d', is joined above. In this groove is placed a film of plumbago (indicated by a') or other suitable resisting material.

The key, C, for regulating the resistance, is composed of the horizontal arm, e, one end pivoted to the stud, f (the centre whereof coincides with the centre from the groove, a, is struck). The opposite end of the arm is joined to the right-angular stud, g, in the free end of which is pivoted a friction-wheel, h, resting in groove, a, on the resistant, a'.

The lower end of stud, f, projects through plate, A, and is connected with one end of metal strip, i, under the plate, the opposite end of said strip being joined to the binding-post, j, to which wire, k, is connected.

Across the groove, a, in radial lines, are placed strips of tin-foil, l, at regular or irregular intervals. These strips graduate the groove, and are intended to indicate the point to which the key must be moved in order to obtain a certain required resistance.

The operation of the instrument is as follows: When the key is turned so that the friction-wheel is in the slot in screw, b, the current flows from metal connection, c, through key, C, thence through metal strip, i, to wire, k. When resistance is required the key is moved over the groove until it reaches the point marked by the tinfoil strip indicating the number of ohms of resistance desired. Now the current has to flow through the resistant in the groove, a, before reaching the key, and thus the resistance desired is obtained.

In Fig. 3 a modification of the invention is shown. Here the groove is straight, lined with a film of plumbago or other resistant.

Fig. 1.

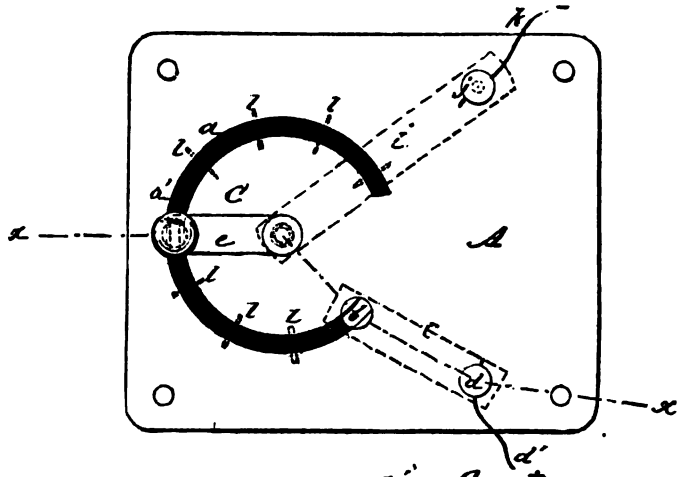


Fig. 2

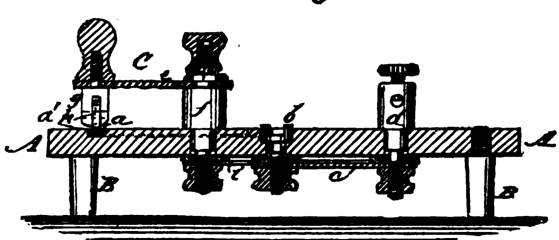
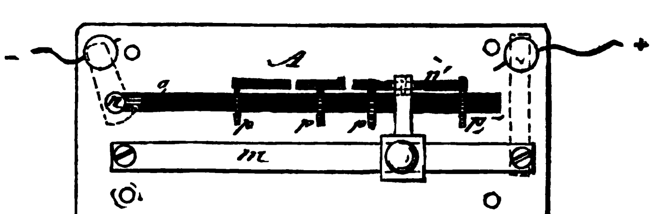


Fig. 3



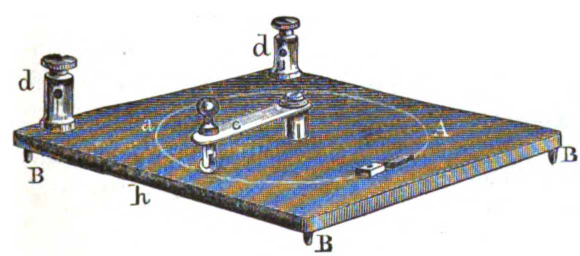
The arm of the key is slotted and passed upon the straight metal bar, *m*, so as to slide freely back and forth, and is provided with a set-screw to fix it in any required position on the bar.

The roller or wheel, *n'*, on the key runs on the side of the resistant, *o*, but parallel to it. Narrow strips, *p*, of metallic foil, with right-angular end pieces, are placed across the resistant at right angles, so as to be crossed by the friction-wheel when moved back and forth. In this way the resistant is brought into the circuit. The foil strips serve to graduate the resistance, as before described.

The advantage of this arrangement is, that the plumbago, being free from the friction of the wheel, is not worn away, and thus its conductivity is not lessened, and greater accuracy is obtained. This arrangement may be applied to the segmental groove first described, as well as to the modification shown in Fig. 3.

As a resisting medium I employ the film of plumbago, or else, where a very high resistance is required, a mixture of plumbago and powdered glass, or plaster of Paris, made into a paste with a suitable cement.

FIG. 4.



While a groove is shown, and described, it is not essential that the resistant should be placed therein under all circumstances. In cases where a groove could not conveniently be made in the plate (where the latter is of glass or paper, for example), a segmental or straight band of the plumbago or other resistant can be placed upon the plate, forming a track upon which the key moves; or, in case the metallic-foil graduating-strips are employed, the key can be moved in a parallel line to the resistant, so as to cross these strips, as before described.

Fig. 4 represents the finished instrument as it stands on the table or battery.

As the instrument is applicable in any department of science in which electricity is used, I found it necessary to protect the invention by a patent; but this does not materially raise the price of the instrument as made for medical purposes. It can be obtained from

any medical battery maker at less than one-tenth the cost of a Brenner's rheostat giving the same resistance.

BOOKS AND PAMPHLETS RECEIVED.

Physician and Surgeon.
Scientific American.
The Medical Counsellor.
The Archives of Medicine.
The Hahnemannian Monthly.
The Druggists' Circular.
The North American Journal of Homœopathy.
The Medical Tribune.
The Chicago Medical Times.
The Hospital Gazette.
The St. Louis Clinical Review.
The Homœopathic News.
Electricity, its Nature and Forms, a pamphlet of fifteen pages. C. W. Boyce, M.D. Published by Chatterton & Co., Chicago.
American Nervousness. By George M. Beard. Pamphlet of twenty-four pages.
The Southern Medical Record.
El Hahnemanniano.
The St. Louis Clinical Record.
The Michigan Medical News.
Revue Homœopathique.
The Buffalo Medical and Surgical Journal.
The Southern Clinic.

ERRATUM.

In our last number, the account of the dissection of the brain of the male chimpanzee, was taken from the *Scientific American*. Through an inadvertence the source was not acknowledged.

Sparks and Flashes.

Ignorance and Impudence.—We quote the following from the *Medical Brief*.

"*Nitroglycerin in Angina Pectoris.*—William Murrel, M.R.C.P., in the *Lancet*, recommends Nitroglycerin highly in angina pectoris. He begins with drop doses of the one per cent. (1st centesimal)

Nitroglycerin solution, thrice daily, and increases it as the case may be. Fifteen-drop doses have sometimes produced unpleasant symptoms. The homœopaths, no doubt, give this medicine in 'explosive vomiting.'" [If the author of the article in the *Lancet*, and the editor of the *Medical Brief*, had studied the homœopathic Materia Medica before rushing into print with their Nitroglycerin, they would have known the value of this agent in angina pectoris, they would have known the *unpleasant* (?) effects produced by a fifteen-drop dose of the 1st dilution, and would have saved themselves from appearing in the ridiculous position they now occupy.]

ANOTHER DOSE OF THE SAME KIND.—The following letter and reply appeared in the *British Medical Journal*, June 14th last.

"SIR: Will you favor me with your opinion of the following circumstances that recently occurred to me?

"An old patient of mine, suddenly taken ill, was persuaded by a friend to send for a local homœopath. As the patient did not improve, he requested his family to send for me. This was explained to the gentleman in attendance; and he desired them to inform me that he would be glad to meet me in consultation. I explained that I could not do so. The same evening, a local F.R.C.S., at the request of the homœopath, was sent for, and attended the consultation without any hesitation. I have since been informed that the consultants of a neighboring town have not declined to meet the same gentleman. Under the circumstances, was I justified in throwing away an old patient, who is, of course, indignant at my refusal? For I am only, sir, yours obediently,

"A NEMO."

*** The following extract from Dr. Styrap's *Code of Medical Ethics*, chapter 2, section 4, page 30, fully expresses our opinion on the points involved in the above letter.

". . . . . . Indeed, for a legitimate or orthodox practitioner to meet a professor of homœopathy in consultation is a dishonest and a degrading act; dishonest, because he lends his countenance to that which he knows to be a dangerous fallacy; and degrading, inasmuch as he has neither manly professional honesty to resist the temptation of a possibly liberal fee, nor the moral courage to discountenance the capricious vagaries of some wealthy, or may be titled, patient."—*British Medical Journal*, June 14th, p. 919.

[A dangerous fallacy is good! If we accept the opinion of the editor of the *British Medical Journal*, there are in the United States six thousand dangerous and fallacious physicians; and presuming that each of those physicians have an average, say, of five hundred persons who employ them, and of course believe in their fallacy,

there are in this country at least three millions of dangerous and fallacious persons, with whom it is dishonest and degrading to hold any communication, or to encourage in any way. We can scarcely accept the opinion of the editor of the *British Medical Journal*, even when backed by a fossilized code of ethics, as the opinion of the majority of English physicians, whom we have always found to be gentlemen. By way of a relief from this kind of literature read the following:

WE want more liberality and less sectarianism; are partisans of liberty; do not ask toleration,—such a boon is a stigma upon any deserving man or cause,—and of all who *will* be our adversaries we demand honorable courtesy and acknowledgment. We thank no man for tolerating our opinions on anything, nor do we give him any praise for it any more than we thank him for the liberty of breathing with him a common air. People who are intolerant—and we are informed that there are such even in the medical profession—are simply indecent. They are devoid of courtesy. They are boors, who are out of place among free people, and ought to be persistently snubbed until they learn the common decencies of intellectual and moral life. The spirit of intolerance is a spirit of discourtesy and insult, and there is no more praise due a man, or a sect, for being tolerant than there is due a man for being a gentleman; and we never saw a gentleman yet who would not take praise for being a gentleman as involving an insult. There is virtue, however, lying in this region, though, alas, but little known by sectarians, which needs development. Men tolerate each other and each other's sentiments and opinions, but are too apt to be content with that. They should go further, and respect each other's manhood, truthfulness, and earnestness; recognize each other as seekers for truth, and love and delight in each other as such. The fact that the diverse medical schools exist, and find vitality enough in their ideas to keep them living prosperously, shows that there is something to be learned and worthy of preservation among them all, and that the policy is poor which shuts them away from one another's society. We are all interested in the same things; diversities result simply from regarding them from different angles.—*The N. Y. Eclectic Medical and Surgical Journal.*

THE time has come when all students of medicine should move on together in intelligent, progressive investigation, viewing all the wealth of clinical facts and data, from whatever source obtained, from the broad standpoint of their bearing upon theory and practice. Physicians profess to be actuated by high motives, and they live in an atmosphere of responsibility. All this should tend to make the medical profession, of all professions, the most liberal. If the homœopathic school would refer to Hahnemann less, and to

facts and results more; if the allopathic would think of Hahnemann less, and look with more unprejudiced eyes at the results of the rational homœopathic practice, the science of medicine might take a step forward, and, freed from the trammels of prejudice and bigotry, the profession might labor impartially for the largest progress, instead of wasting energies in the defence of tenets and opinions. Hahnemann was human; Hippocrates and Galen were human—all subject to every human frailty, but the principles which they enunciated are independent of their frailties.—*The Homœopathic Times.*

SCIENTIFIC EDUCATION.—It would certainly be a great boon to the world if the general level of scientific education could be raised, so that each young man or young woman, when he or she issues from school-doors, should have enough definite knowledge of the great laws of the physical universe to instantly denounce blue-glass theories and attempts at perpetual motion, not from the pride of knowledge, but from the feeling that error, credulity, and superstition should be combated with truth.—PROFESSOR JOHN TROWBRIDGE, *Scientific American.*

Miscellaneous Items.

TOBACCO BLINDNESS.—The following are the conclusions at which Dr. Martin has arrived, in his recent thesis for the doctor's degree, regarding disorders of the eyes produced by tobacco.

1st. It is easy to distinguish between amblyopia caused by alcoholic poisoning and by the abuse of nicotin, as in both cases the affection presents characteristic symptoms.

2d. The most important of these symptoms is the condition of the pupil, which is dilated in alcoholic amblyopia and contracted in the other case. In the first case, the affection progresses irregularly and with occasional changes for the better, which are followed by relapses; while, in the second case, its progress is slow but uninterrupted. In the one, both eyes are affected to the same extent; in the other, they are not both affected, at least not simultaneously. The patients do not see as well at night as during the daytime, and do not suffer from hallucinations, illusions of sight, or diplopia. In alcoholic amblyopia, on the contrary, the patients cannot bear a strong light, see better during the night, and complain of hallucinations, polyopia, and diplopia.

3d. Visual disturbances, when connected with poisoning by tobacco, are manifested under the following forms:

a. Binocular amblyopia.

b. Muscular amblyopia with central scotoma.

c. Amblyopia caused by both tobacco and alcohol.—*British Medical Journal.*

DR. MARTIN, of Berlin, has extirpated the kidney five times. Four of his operations were successful.

PROFESSOR SNELLER, of Utrecht, prefers the use of carbolized air to the carbolic spray in surgical operations.

PROFESSOR GALLOWAY proposes the use of Phosphate of potash as a condiment, especially where much salt meat is eaten. He points out that Phosphate of potash is the principal material extracted from meat in the process of salting, and holds it evident that it ought to be replaced to give the salted meat its original nutritive value. He also suggests that Phosphate of potash will be more useful than Lime-juice in preventing scurvy.—*Scientific American.*

CURARE IN EPILEPSY.—In the opinion of Kunze we possess in Curare a remedy by means of which we may cure cases of epilepsy of long standing. He employs a solution of seven grains of Curare in seventy-five minims of water, to which he adds two drops of Hydrochloric acid. At intervals of about a week he injects beneath the skin eight drops of this solution, and in various cases in which convulsions had occurred for several years he obtained a complete cure after eight or ten injections.—*Canada Medical Record.*

WE have it on the authority of Dr. Bock, of Leipsic, that the nervousness and peevishness of our times are chiefly attributable to tea and coffee; the digestive organs of confirmed coffee-drinkers are in a state of chronic derangement, which reacts upon the brain, producing fretful and lachrymose moods. Ladies addicted to strong coffee have a characteristic temper, which might be described as a mania for acting the persecuted saint. Chocolate, he adds, is neutral in its psychic effects, and is really the most harmless of our fashionable drinks.—*Scientific American.*

AN OLD NEURALGIA CURED BY AN OPERATION. BY JOHN T. KING, M.D., OF BALTIMORE, MD.—Mr. W. J. H., æt. 48, merchant, slender and pale, has enjoyed good health, with exception of repeated attacks of neuralgia. Devoted to an extensive business, with little time for recreation; of perfectly temperate habits. When quite young he fell, striking the frontal bone, and depressing to a considerable degree the outer tablet. Included in the cicatrix which remained was the supraorbital nerve at a point about an inch above the supraorbital foramen. The tissues were firmly bound to the depressed bone. From his own statement, as well as that of his

parents, we are unable to say positively that neuralgia followed the injury immediately, though we know nothing to the contrary, as both were established so early in life; though I think the sequel will demonstrate that the neuralgic affection followed the injury as cause and effect.

Since early boyhood, however, he has been a martyr to neuralgia; scarcely a day passed in which he did not feel more or less pain over the right hemicranial region. At times he is almost distracted, suffering intense agony for days, the least exposure insuring an attack.

He came under my professional notice about a year ago; the usual remedies were resorted to. Quinia, in large doses, and other alkaloids of Cinchona, Salicylic acid, Iron, Strychnia, Arsenic, Belladonna, Chloroform, etc., were faithfully tried, and in various combinations, without affording more than temporary relief. I thought an operation justifiable, though I hesitated to promise permanent relief. He appeared anxious that surgical means should be resorted to. In consultation with Dr. Winslow, it was determined to operate at once. Dr. Winslow inserted a narrow bistoury at a point about three-quarters of an inch below the cicatrix, and carried it subcutaneously to about the same distance below, dissecting up the integuments from the pericranium. A tent was introduced through the wound, and retained *in situ* for ten days. Complete relief followed the operation. Though nine months have since elapsed, there has been no return of the neuralgia. Mr. H., feeling such confidence in his cure, has intentionally exposed himself, thus tempting an attack, but none followed. His general condition has likewise improved, as would be expected—*American Journal of Medical Sciences, July*, 1879, p. 156.

AN ELECTRICAL ENDOSCOPE.—Dr. Hedinger, of Stuttgart, has introduced a variety of mirrors of different shapes to suit the various cavities, which will doubtless prove to be superior to those at present in use. The light generated by passing a powerful galvanic current through a platinum coil lights up the cavity, and at the same time, by keeping the mirror warm, prevents the condensation of moisture upon its reflecting surface. Silver is used for the reflecting medium, since it is not in danger of being broken by the amount of heat employed.—*Hospital Gazette.*

THE DR. S. M. PLUSH BATTERY CELL.—This battery cell is a modification of the Callaud battery, and consists of a glass jar, of the usual proportions, having at the bottom a copper plate, upon which is placed sulphate of copper, and has attached to it an insulated wire, forming the positive pole. About half-way down the

inside of the glass jar is a shelf, made of a perforated sheet of copper, upon which is placed pieces of zinc of any form. The shelf is suspended by three strips of copper, one of which constitutes the negative pole. With this form of cell, the zinc of commerce can be broken into pieces of suitable size and used without any other preparation, and the zinc can all be consumed; while in the Callaud battery the zinc must be cast into suitable form, involving some loss of metal and expense; and as a considerable percentage of the zinc of such castings is not consumed, it must be remelted at still further loss. Another advantage is, that the sulphate of copper can be fed into the bottom of the cell through the opening left by turning up one side of the shelf, and broken zinc placed upon the shelf without disturbing any of the connections, thus making the battery absolutely continuous. Objection has been urged that there will be local action between the zinc and the copper of the shelf, but Dr. Plush holds that practically no such action can take place, as there is really no closed circuit between the pieces of zinc and the copper. Lead may be substituted for copper in making the shelf.—*Scientific American Supplement.*

DR. N. S. FOSTER recommends subcutaneous injections of Ergotin, as a means of checking cerebral hæmorrhage.—*Lancet.*

CHOREA.—Dr. Purkhauser recommends propylamine as a prompt remedy in chorea, given in from fifteen to twenty grains a day.—*Homœopathic Times.*

VALUE OF FISH AS BRAIN-FOOD.—Dr. Draper thinks that stupid people may as well stop eating quantities of fish for the purpose of repairing the deficiencies of nature, for it won't make them intellectual. In brief, fish doesn't contain an excess of phosphorus, and when dead fish "shine as bright as the stars of night," it positively isn't owing to the presence of phosphorus, but to the oxidation of carbon.—*Scientific American.*

PILOCARPIN.—We notice reported two cases, in which this drug was used hypodermically for some affection of the eye. Both patients were bald-headed. Immediately after the use of the remedy the hair of both began to grow, and eventually became quite luxuriant crops.

We understand that the editor of one of our prominent medical journals is now trying the effect of the remedy on himself by rubbing it in,

"In de place where de wool ort to grow."

We hope he will report results.

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Original Articles.

ARTICLE XI.

ELECTRICITY IN AURAL DISEASES.

BY HENRY C. HOUGHTON, M.D., NEW YORK CITY.

UNSUPPORTED assertions regarding any subject-matter in medicine or surgery are of no value whatsoever. An hypothesis may lead to correct conclusions, but until the supposition ends in the fact it is not entitled to much consideration.

No one matter has caused more extremes of assertion than the value of electricity, but it has long since passed from the domain of the charlatan to the foremost place among the imponderable agents used for human welfare.

As regards the value of electricity in diseases of the ear, we shall find very marked extremes. Roosa says: "This is an agent whose real value has been much underestimated in many departments of medicine, but which, I am inclined to believe, has been overrated in the treatment of aural disease. The effect of electricity on the acoustic nerve will be fully discussed in the

third part of this volume, while it is only necessary to say at this point that not much is to be expected from the use of electricity in chronic non-suppurative inflammation of the middle ear." In part third of his work he gives the arguments *pro* and *con*, regarding the reaction of the nerve, and leans to the side of those who claim that the sounds of Brenner's formula are due to muscular contraction. Burnett, in his admirable treatise, favors Brenner's claim of direct stimulation of the acoustic nerve, but in commenting on Webér-Diel's electrization of the Eustachian tube and tympanum, he does not accept that writer's view, but suggests that the physical manipulation of the diseased parts is the cause of relief, and not the passage of the electric current. I hope to show that relief does follow the passage of the current when the manipulation as performed by Webér-Diel is omitted.

In contrast to the opinions of Roosa and Burnett; Professor C. J. Blake, of Boston, and America has no superior authority, supports by his own observations the claims made by Brenner and others. In vol. i, of *Knapp's Archives*, Dr. W. Erb, of Heidelberg, confirms Brenner's researches, and in his closing remarks quotes Brenner as follows: "*The examination of a diseased ear will only be complete when the auditory nerve has been examined by means of the galvanic current.*" I might quote from other authorities only to show that the skeptics are found to be those who have not used electricity to any extent, and the believers those who have made careful and full use of this agent.

I do not propose to go into an extended consideration of the philosophy of electricity, but to touch a few points bearing directly on our theme.

In the treatment of the ear we deal with: (1) skin and mucous membrane; (2) muscle; (3) nerve. The action of the galvanic current on the skin is to produce a burning, which becomes painful as the current is more intense. If long continued vesicles form, and even hæmorrhage has resulted in some cases. The action of the two poles is markedly different. Serum thrown out at the anode is acid, and the

change in tissue is not very marked. At the cathode an inflammatory areola is formed, the serum is acid and becomes dark in color. Faradization causes a more decided pricking pain and changes in superficial bloodvessels, but only a very powerful current affects the deeper tissues. Faradism acts more immediately on the vasomotor nerves, causing, first, contraction of bloodvessels, afterwards, dilatation.

Electricity, either as galvanism or faradism, increases the action of mucous glands, and its chemical effects are more prompt and serious than upon the skin.

The relation of muscle and motor nerve is so intimate that we consider them together. Electricity increases the functional activity of muscular tissue by its action on nerve, or on muscle fibre, or on both. Althaus says: "The galvano-muscular contractions do not take place in consequence of the motor nerves simply conducting the electric fluid to the muscles, although the nerves are undoubtedly conductors of electricity. But the mere conductivity of the nerves does not explain the physiological effect produced by their electric stimulation; for if a wet thread be tightly applied to a nerve, so that it becomes thin and reduced to its neurilemma, no contractions can be caused in the muscles animated by it on applying the electrodes above the point where the nerve has been tied, although by such a proceeding the propagation of electricity is not arrested, since the wet thread conducts equally well as the nerve. Again, a few drops of ether, applied to any point of the nerve, will suspend the contraction of the muscles, if the electrodes are placed at or above the point where ether has been applied. The contractions, however, will reappear when the effects of the ether have passed off. Finally, if the nerves of a frog be galvanized, which has been poisoned with woorara, no contraction occurs in the muscles animated by these nerves, although woorara does not affect the electric conductivity of the nerves, which remains intact, nor the contractile power of the muscles, for they are seen to suffer commotions if the electric current is applied directly to their tissue without the intervention of the nerves; but the contraction fails to appear because woorar

destroys that peculiar force by which the nerves are enabled to produce the play of the muscles. *Hence it results that contractions of the muscles cannot be produced by galvanic stimulation of the motor nerves, unless the nerves be in a state of integrity; and that the galvanic current act in this manner by rousing the vital properties of the motor nerves."* Space will not permit reference to the laws of electricity as enunciated by Du Bois-Reymond, Pflüger, and others, but it may be succinctly stated that galvanism is specially adapted to promote the function of nerve tissue by action on large trunks, and faradism to promote muscular activity by direct action on muscular tissue and small branches of motor nerves.

The nerves of special sense each react to the galvanic current. Flashes of light occur on closing and opening the circuit, if the poles are applied near the eye. Action on the olfactory nerve produces a peculiar smell. The gustatory nerve responds to very feeble currents, causing the "galvanic taste," and we should naturally expect that the acoustic nerve would not be an exception, but it is difficult to produce a satisfactory reaction of the acoustic nerve on account of the nausea, vertigo, and other symptoms produced by a large number of elements introduced into the circuit. Brenner, of St. Petersburg, first formulated the reaction of the nerve thus:

CaMaS = Cathode, making sound.

CaClSx = Cathode, closed circuit, sound gradually vanishing.

CaBrO = Cathode, breaking, nothing.

AnMaO = Anode, making, nothing.

AnClO = Anode, closed circuit, nothing.

AnBrO = Anode, breaking, feeble short sound.

Exceptions were taken to Brenner's views, and a war of words has followed, but, as I have said, the balance of authority is with Brenner.

If, then, galvanism acts upon skin, mucous membrane, motor nerve, and muscle, as well as upon other nerves of special sense, we may expect it to prove of value in the treatment of aural diseases.

The known in the therapeutics of electricity is to the unknown as o to ∞. We stand amazed at the utilization of this force in other departments of life's necessities, but I believe we are to see equally valuable applications of electricity as a curative agent. Electricity is allied to vital force as vital force is allied to spiritual force, and the human mind and soul stands as yet in the early dawn of a knowledge and application of either.

That the passage of the galvanic current increases the functional activity of the auditory apparatus must be conceded. Whatever may be our view as to the part or parts of the same that is influenced thereby, the improvement in audition is marked for musical tones; the tuning-fork being heard at a greater distance and for a longer time, also the perception of higher tones, *i. e.*, musical tones caused by a greater number of vibrations. The same is true of the watch test, and later of the spoken and whispered voice.

In some cases I have noted the fact that the gain for the watch did not keep pace with the gain for the voice; usually the gain corresponds. After the lapse of a number of hours the tests show a fall off from the results immediately after galvanization. In cases where torpor of the nerve was complicated by tinnitus aurium, galvanization modified the subjective sounds; and in cases permanently relieved, the tinnitus did not rise to former intensity from sitting to sitting. If tinnitus rises to same intensity after one sitting before the following one, the prognosis is unfavorable. In many cases of so-called hyperæsthesia of the auditory nerve, I am convinced that the irritation was due to lesions in the tympanum or the Eustachian tube, or both, for the passage of a mild current abolished the subjective sounds; a current far short of that required to cause reaction of the auditory nerve according to the formula.

This leads me to the consideration of the action of the faradic as well as the galvanic current in the middle ear. In my early use of electricity, in common with many others, I depended upon the galvanic current, applying the electrodes

externally, and obtained good results. In volume xi, *New York State Transactions*, will be found an article giving some results, and at the meeting of that year instruments were exhibited, fitted to accomplish the same end as those proposed by Webér-Diel. A Eustachian electrode passed to the orifice of the tube was attached to the anode, and a suitable sponge electrode, filling the external meatus, to the cathode. After the passage of the galvanic current, the inflation by Politzer's method was more easily accomplished, and in many cases obstinate occlusion overcome. After a time, thinking that the passage of galvanism would prove tonic to the muscles of the pharynx, a tongue electrode was substituted for the Eustachian one, and proved even better, if possible; at all events more convenient, as the passage of an electrode through the nose is "not to be sneezed at." In volume V. of *Knapp's Archives*, Professor C. J. Blake reviews articles by Field and Itard on the use of electricity in the treatment of tinnitus aurium. This became the occasion of an article by the late E. B. Squier, M.D., whose early decease we who knew him well must mutually regret. As chairman of the bureau I added some remarks on the paper, arguing strongly in support of Itard's deductions, but the discussion led me to use faradism in cases not relieved by galvanism, and I am now ready to admit that it, or the alternate use of it and galvanism, have cured cases of tinnitus not controlled by galvanism alone. Certain well-established principles guide me in the treatment of deafness, whether complicated by tinnitus or free from subjective sounds. Galvanism is profoundly alterative, chemical in action, rousing vitality, and taxing it to its utmost. Hence its value in the early treatment of a paralysis, as for instance of an extremity, by action on large nerve trunks; later faradism will supplement the work by stimulating single muscles by direct application. So in dealing with the ear, the muscles of the pharynx, the Eustachian tube, and the muscles of the middle ear are roused by the galvanism, the mucous glands are made active, the nutrition of the whole tract is promoted, and we enter upon a new life. Later in the treatment, faradism can be used to advantage, and to a greater

extent, but it is my practice to use the galvanism at intervals, perhaps every third or fourth sitting in a succession of sitings.

Although this method does not show as brilliant results as that proposed by Campbell, *i. e.*, flooding the tympanum with a solution of Iodide of potassium and then passing galvanism, yet it is more free from risk, as his method causes a low grade of inflammation, and the operator must be very cautious, and guard against acute inflammation of the middle ear. I give the details of a few cases treated:

February 3d, 1879. J. W. C., male, age 40; had been deaf many years and supposed there was no hope in his case, as he has been told that the "drumheads were destroyed;" hears watch, R. $\frac{2}{240}$, L. $\frac{34}{240}$; both membranes were badly scarred and small perforations existed, on the right side in the posterior inferior quadrant, on the left side in the anterior inferior quadrant; the Eustachian tubes were dilatable; the pharyngeal mucous membrane was thick and red; tonsils hypertrophied.

He was treated with the galvanic current passed through the Eustachian tubes; later, faradism was used.

March 1st. Hears, R. $\frac{40}{240}$, L. $\frac{5}{20}$.

April 1st. Hears, R. $\frac{9}{20}$, L. $\frac{10}{20}$.

May 1st. Hears, R. $\frac{18}{20}$, L. $\frac{18}{20}$.

Merc. prot. was given through February and March; Baryta mur. during April, the latter for snapping sounds associated with extra patency of Eustachian tube.

W. H. P., male, age 45, 1877, October 19th. In March, 1877, had acute inflammation of middle ear, L.; now has a constant hissing in the ear and loss of power; hears, R. $\frac{4}{20}$, L. $\frac{10}{20} \times 12 = \frac{10}{240}$; a mild galvanic current was passed through the Eustachian tube; hears, $\frac{20}{240}$.

October 22d. R. $\frac{6}{20}$, L. $\frac{16}{240}$; no hissing; galvanic current 15 elements, Tiemans and Halske, R. $\frac{7}{20}$, L. $\frac{2}{20}$; head feels clearer; qims.

October 26th. R. $\frac{1}{20}$, L. $\frac{2}{20}$; after exposure and loss of sleep the subjective sounds returned 15 elements, 16,000° resistance; hissing ceased at once, R. $\frac{8}{20}$, L. $\frac{32}{240}$.

November 5th. R. $\frac{10}{20}$, L. $\frac{30}{240}$; hissing, 10 elements, 16,000°; these ceased at once, R. $\frac{16}{20}$, L. $\frac{30}{240}$, Md. 30.

November 9th. After cold in the head L. fell to $\frac{20}{248}$; used tongue electrodes and passed 10 elements; gave to L. $\frac{35}{240}$, and R. remained at $\frac{20}{20}$.

November 15th. R. $\frac{20}{20}$, L. $\frac{4}{20}$.

At date of writing this article the case has held up to standard on the R., and the L. has been so relieved that the patient did not feel the necessity of treatment, although my purpose would be to continue the sittings until the hearing on the left side rose to $\frac{20}{20}$, which I am confident could be accomplished.

Chronic catarrhal inflammation of the middle ear. A. B. C., physician, age 40. December 11th, 1874. Has had naso-pharyngeal catarrh for a number of years; lately he has noticed that upon attempting auscultation in his daily practice, he was unable to detect murmurs as well with the left as the right ear.

R. M. E., normal; M. T., normal; E. T., dilatable. Hears, $\frac{20}{20}$. L. M. E., normal; M. T., retracted, but mobile; E. T. dilatable, after two trials by Politzer's method of inflation. Hears, $\frac{24}{240}$.

After a few treatments it was clear to me that the lesion was due to lack of motor power in the tympanic muscles, as the Eustachian tube was readily dilated by Valsalva's experiment, and the membrana tympani was easily moved by Siegle's speculum. Hence the galvanic current was employed. The electrodes were placed in such a manner that both the cerebro-spinal and the organic nerve supply to the tympanum were brought into the circuit, the positive pole being placed over the trifacial in front of the auricle, the negative over the superior cervical ganglion at the angle of the inferior maxillary. For one month the applications were made three times each week.

January 13th. Hears, $\frac{5}{20}$. During the second month the treatment was more irregular.

February 13th. Hears before treatment, $\frac{14}{20}$; after treatment, $\frac{20}{20}$.

February 13th. Hears, $\frac{20}{20}$.

October 6th, 1879. The hearing has remained good ever since.

Article XII.

HOW TO PERFORM ELECTRO-SURGICAL OPERATIONS.

BY JOHN BUTLER, M.D.

(Continued from page 99.)

Aneurism.

The galvanic current is employed in the treatment of aneurism for the sake of its effects in causing coagulation of blood, the object in view being to form a firm coagulum within the sac, which shall fill or nearly fill the greater part of it, and so obliterate its cavity. Now it is evident that as a certain amount of current will coagulate a certain amount of blood in a certain time, that the quantity of current and length of time consumed should be as accurately as possible proportioned to the size of the aneurism to be operated upon, and that it should be ascertained beforehand, how long it will take a current producing a known deflection of the needle of a *given* galvanometer (not a galvanoscope) to produce a clot of the required size. The slower the coagulum is formed the better will be the result; that is to say, a coagulum formed by the use of a very weak current, transmitted for a long time, is much firmer and denser than one produced in a short time by a strong current. It is moreover not liable to be broken up by the evolution of the mixed gases produced by the decomposition of the water of the blood; nor is there any danger of sending a bubble of these gases through the heart, as the gases being very slowly evolved, rise gently through the coagulating fluid, are carried

away gradually in the circulation, and are absorbed by the animal economy, before they can accumulate in quantities sufficient to produce any injurious effect; while the opposite is true of a strong current.

As the clot caused by the positive pole is much firmer in its texture than that produced by the negative, we should utilize this fact in the treatment of aneurism. I have elsewhere* suggested in outline a new method of treating aneurism by galvano-puncture, and now propose giving the operation in detail.

Four, five, or six fine soft iron needles, insulated with *hard rubber* to within a quarter of an inch of the points, should be inserted into the cavity of the sac, to the part where it is most essential the coagulum should lie; these needles should be about half an inch apart. A single fine needle insulated in the same way should be then inserted well within the sac, at the distance of about an inch, or an inch and a half from any one of the first group of needles. The first group should now be connected with the positive pole of the battery intended to be used, and the single needle with the negative. A galvanometer, which will accurately indicate the amount of coagulation per unit of time, should be included in the circuit.

A current that will coagulate not more than about an eighth of a cubic inch of blood to each needle per hour is, perhaps, the best strength suited for practical purposes. The above conditions having been fulfilled, and the circuit closed with the necessary number of cells included, to produce the pre-ascertained amount of deflection of the galvanometer needle, the coagulation commences. After the current flows for a few moments it will be noticed that the deflection of the needle becomes less, that is, falls from the point required; this is due to the resistance being increased by the oxidation of the needles, by the slight polarization of the negative needle, and by the fact of the coagulum in process of formation being a poorer conductor than the liquid blood. When this fall in the de-

* Textbook of Electro-Therapeutics and Electro-Surgery, 2d edition, page 225.

flection takes place, the number of cells should be increased, or else, where a rheostat is used, a number of resistances should be removed, until the galvanometer again shows that the necessary amount of current flows. At this point it should be fixedly kept until the close of the operation. During the procedure the positive needles become acted upon chemically by the acid set free, and are converted into chloride of iron, which materially assists in the formation of a firm clot. This fact should be calculated, and the exact value of this secondary electrolytic action carefully estimated before undertaking the operation. As the needles of the positive pole firmly adhere to the former clot, their withdrawal is liable to break up the clot and so entirely destroy the effect of the operation. This can be entirely avoided by using needles of such a size that it will be necessary to entirely consume the uninsulated parts of them in the formation of the coagulum; the point at which this total destruction of the points of the needles is reached, is readily ascertained by the galvanometer falling to zero, showing that the circuit is broken. The operation is now completed, and the insulated stumps can easily be withdrawn without the escape of a drop of blood. There may be some slight oozing at the point of insertion of the negative needle, and a few bubbles of hydrogen gas may escape; but this is a matter of no moment, and can be arrested by a slight pressure of the finger for a short time. The pain of inserting the needles should be avoided by the use of a local anæsthetic in the form of ether or rhigolene spray. After the needles are in position, the patient feels no sensation whatever, as there is no pain produced by the very mild current; and so there is no contra-indication to continuing the operation several hours, during which time the galvanometer should be carefully watched, and the current regulated accordingly.

Poore,* quoting the opinion of Ciniselli, says: "The operation of galvano-puncture is admissible in certain cases. It must be employed for internal aneurisms only, and for such as

* Electricity in Medicine and Surgery, p. 248.

are not too far advanced. Those are the most favorable in which the sac presses upon but has not perforated the parietes. A large external sac is a decided contraindication. Sacculated aneurisms having moderately small openings, indicated by a distinct *bruit*, or, better still, by a double *bruit*, are the most favorable for operation. The origin of large trunks from the sac of an aneurism is a contraindication."

It is perhaps almost unnecessary to add that where there is evidence of a general atheromatous condition of the blood-vessels the prognosis is not a favorable one; but even where this is the case, the length of a patient's life may be added to materially by operating at an earlier stage of the disease.

Where the conditions above indicated are *all* accurately fulfilled, there can be no possible injury done to the patient, as there is no shock, no pain, no inflammatory action, and with due care there needs be no possibility of embolism.

NÆVUS.

In the treatment of this affection by means of electricity, the result aimed at is simply coagulation of the blood contained in the network of little vessels which form the hyper-vascular tissue, with as little action as possible on the surrounding skin and cellular tissue. The result of electro-puncture properly performed on a superficial nævus is, that the nævus shrivels, dries up, and forms a scab, which falls off in a few days, leaving the surface beneath in a healthy condition. On deeper nævi the result is somewhat different, as will be shown presently.

For the purpose of describing the details of the modes of operating, and the different results attainable, we may divide nævi into three kinds, viz.:

1. Those which involve the skin only.
2. Those in which the cellular tissue is the seat of the disease.
3. Those in which both skin and cellular tissue are included.

We will consider the last-mentioned kind first. I have

treated this form by a great variety of methods, but of late years have given preference to the following: Having transfixed the base of the growth with a number of very fine harelip pins, about an eighth of an inch apart, I make a connection between the poles of the battery and each alternate pin; that is to say, suppose the base of the tumor has been transfixed by eight pins, parallel to each other, I connect the first, third, fifth, and seventh to one pole of the battery, and the remainder to the other. The current may now be allowed to flow, and continued until the growth has acquired a grayish-white, or dull leaden-colored appearance, and has become comparatively quite hard. The operation is now completed, and the pins may be withdrawn. The negative pins almost fall out by themselves, but those attached to the positive (unless made of platinum), having become corroded, firmly adhere to the tissue in which they are imbedded, and require much care in their removal. Reversing the poles for a moment or two just before the close of the operation, will greatly facilitate their removal. Any bleeding from the openings made by the pins is positive evidence that the coagulation is not complete, and it certainly is much better when this happens to reinsert the pins and continue the seance, than leave the matter for another operation. No dressing needs be used. After eight to twelve days the whole nævus falls off in the shape of a scab, and sometimes leaves, (especially when the nævus is small) a fully healed surface beneath; but in the case of a large nævus there is left a comparatively small, superficial, healthy ulcer, which speedily heals, and leaves a slight cicatrix, that is not always permanent, and is never contracted when the amount of current used has been strictly proportionate to the amount of work to be accomplished. These cases always need the use of an anæsthetic during the commencement of the operation. I am in the habit of using Johnston Brothers' condensed Nitrous oxide with adults and large children, discontinuing its use during the latter part of the proceeding, which is quite painless, owing to the tissues having become numbed by the action of the current. With in-

fants I use chloroform, as complete and continued anæsthesia is requisite, for obvious reasons.

Nævi which are situated deeply in the areolar tissue, and do not involve the skin, must be treated somewhat differently. Insulated needles must be used. The easiest mode of operating is to insert three or four needles (not too fine) to near the centre of the growth, the points at which the needles come in contact with the skin being thoroughly protected by the insulation, and the parts of the needles within the tissue entirely uninsulated. A mild current and plenty of time is the best procedure. It is not so easy to tell when sufficient action has taken place in these as in the preceding form, so that it is well to accurately take into calculation the amount of work to be performed, and the amount of current and time necessary to perform it, before commencing to operate, and to see that this is accurately measured and indicated by the galvanometer during the seance. In very small deep nævi the result may be absorption of the clot formed, but in the larger ones we generally have suppuration excited by the clot acting as a foreign body, which nature seeks to expel, and so the whole of the abnormal tissue is changed into an abscess, which after some days either discharges itself through one or more of the needle openings, or else, in the event of these having become healed, has to be opened with the aspirator. The same rule holds good with regard to the withdrawal of the needles as previously suggested.

In this form no anæsthetic is needed, unless the pain from the insertion of the needles be dreaded, and pain from this cause can be avoided by the use of the ether spray, locally applied. The action of the current, unless too strong, is not felt, as the skin, protected by the insulation of the needles, is not acted upon by the current.

The third form of nævi are those situated in the skin alone, without penetrating the subcutaneous structures, popularly known by the terms "port wine marks," "mother's marks," "birth marks," "blood marks," "strawberry marks," "rose marks," and a variety of other pet names, as they happen to

differ in shape, size, color, etc., are readily removed by the galvanic current, but require a totally different operation from either of those previously mentioned, and much skill and experience in the technical details of carrying out the operation.

I have had an instrument made consisting of a number of very fine needles, imbedded in a circular piece of lead, with the points protruding about half their length—something like a Baunscheidt's counter-irritant machine. The needles stand about a sixteenth part of an inch apart, and are inclosed in a hard-rubber or hard-wood cylinder, which is furnished with an adjustable screw collar, by means of which the depth to which the needles penetrate the tissues can be regulated to a fraction of a hair's breadth. The mode of using it is as follows:

A moistened chamois-covered carbon electrode attached to the *positive* pole of the battery is brought into contact with the healthy skin adjoining the nævus. The instrument, with the needles adjusted to the depth the skin is to be punctured, is then joined to the negative pole of the battery, placed on the mark, and the required current allowed to flow. The needles need not be *forced* through the skin, as the action of the current will make them penetrate to the depth required almost by the weight of the instrument alone. As soon as the needles have sunk to their required depth in this way, the action of the current has been sufficient, and they may then be placed on another part of the mark until the whole has been acted upon. A very mild current is all that is required, and as we cannot use a galvanometer, on account of the resistance being varied all the time and having to make several interruptions to move and replace the instrument, the amount of current necessary cannot be calculated beforehand with any degree of precision; so that the operation requires a degree of nicety in carrying out the minor details. If too great pressure be used on the instrument the mechanical action will anticipate the electrolytic, and the part is not sufficiently acted upon in the process of penetration. If too strong a current be used slough-

ing of the part will be the result, and the same will occur if the action even of a mild current be unduly prolonged.

The object to be attained is the production of small coagula at the point of the needles, which act as barriers to the blood supply, and so cut off the too free circulation. The result of a properly conducted operation is, either a scabbing process of the entire mark, or else a series of small scabs, corresponding to the needle punctures, form and are shed in a few days, leaving the skin in the normal condition.

Marks of large area, situated on the head, neck, or face, should not be entirely destroyed at one sitting. I never operate on more than two square inches of surface at a time in such cases. It is better to do a little at a time than transmit a current through the nerve-centres for an unduly long time. Complete anæsthesia will be necessary with children and with most adults. However, I have operated on several cases without an anæsthetic. The pain is not severe, but it is of course essential that the patient should be kept perfectly quiet. It will be noticed that the rules given for performing the above operations differ from those laid down by most of the recognized authorities, who use the active positive pole exclusively, making the connection by having the negative placed upon an indifferent part. The reason they give for this is, that the positive pole produces a firmer clot than the negative. I do not think the density of the clot is of any consequence in the treatment of nævi, and so in the first two forms I utilize both poles for the reasons, that we can effect our purpose with a very much weaker current than with the unipolar method, and the current being transmitted through the nævus only does not expend its physiological action on the surrounding parts, and in the case of deep nævi does not leave a contracted cicatrix, as occurs when the positive pole alone is used. In the case of skin nævi the operation suggested could not be performed with the positive pole, for as soon as the needles touched the skin they would adhere fast under its action, and could not be made to penetrate by any reasonable amount of force; besides the

needles would in a moment become so corroded that the operation could not be completed.

After having tried the operations laid down by authorities, as well as other methods, I have adopted those above given as being the most practicable, most easily performed, and giving the best results.

PIGMENTARY NÆVI.

By transfixing the base of a mole with very fine hairlike needles, about a line apart, connecting them with the negative pole of a battery, and completing the circuit by a needle the terminal of the positive, driven through the body of the growth, we can obliterate these unsightly growths without leaving any mark whatever.

In these cases the current acts by coagulating the blood supply, and so stopping the nutrition, and the result is (as in capillary nævi) that the growth shrivels, scabs, and falls off, leaving a level surface underneath, with the skin perfectly smooth and healthy. One or two Daniels's cells will furnish all the current needed when the growths are small, and from five to fifteen minutes will complete the operation. No anæsthetic needed, as a general rule.

(TO BE CONTINUED.)

ARTICLE XIII.

REFLEX PAINS.

BY W. J. BANER, M.D.

(A paper read before the New York Medico-Chirurgical Society, November 11th, 1879.)

THE following cases are not unique; similar ones are doubtless seen in the practice of all the Fellows of this Society; but common as they may be, their treatment is always difficult, and frequently unsatisfactory. As two specimens of a class of reflex troubles which sometimes embarrass the diagnosis and disturb the treatment, I have thought their full history would be interesting to the Society, and the result of treatment in one case would aid the cure of similar cases by others.

CASE I.—Mollie V., a pale, weakly girl, of fourteen years and five months, applied for treatment in April, 1873. She began to menstruate six months before; periods somewhat irregular; more or less dysmenorrhœa at every period; looks thin and blue; appetite pretty good; always complaining of being weak; food apparently well digested; bowels regular, but a little constipated. She came especially to get advice about a pain in the ball of her right great toe; commenced soon after the first appearance of her menses; always worse before, during, and shortly after her periods, but when she is at her best, in the middle of the interval, she is unable to put her toe to the floor; the tendons from the dorsum of the foot to the shin are contracted to such an extent that she could not put her foot square upon the floor if she were so inclined; the ball of the toe seems a little swollen; not much redness; extremely sensitive to pressure; no fever; sleeps well after she gets her toe in an easy position.

Remained under treatment from April to December, when she disappeared, not at all improved.

CASE II.—H. W., æt. fifteen, consulted me December, 1873, about her left great toe. She has been menstruating nearly a year irregularly, both as to time and character of the flow; when a child, had a slight lateral curvature of the spine, cured apparently by wearing a brace; sister has an uncured curvature of same kind; family scrofulous. Six months before the appearance of the menses commenced to have a pain in the ball of her left great toe; worse now at the time of her being unwell, but she is never free from it; is unable to put her foot to the ground; the tendons on the dorsum of that foot a good deal contracted; walks on her heel; is somewhat relieved a short time in summer; all her digestive functions are well performed; eats well; sleeps well; looks thin and pale blue; the tissues of the ball of the toe are somewhat swollen, though not red; very sensitive to the slightest pressure; feet always cold; is weak and forlorn; has "fainting spells," as her mother calls them; sometimes three or four a day. She has been under all kinds of doctors, with at most only temporary benefit.

After two months of treatment, with but slight benefit, I invited Dr. Thompson to see the case with me, with a possible view to some surgical proceeding, but after an examination a weak solution of the Iodide of potash was advised. She was greatly relieved by this step for some weeks; but the whole trouble returned again with greater severity than ever. After thorough trial of various remedies, extending over a period of three years and a half, with only temporary relief from anything, I had a consultation with Dr. Helmuth, April 4th, 1876. Dr. Helmuth examined the toe thoroughly, and finally advised a return to the Iodide of potash in increased doses. This was done, and persisted in for four months with no improvement. After a trial of electricity, magnetism, rubbing, massage, and various remedies until December, 1876, I made a re-examination of the case, and after due consideration prescribed Silicea^{30}, in powder, two doses *per diem*, for a week. At the end of this time the improvement was so marked that the Silicea was continued; after two weeks the remedy was only given once a day, and finally once in two days, until the cure was complete. Six months of rubbing with sweet oil restored the tendons to their normal length and elasticity.

The symptoms and pathological conditions which suggested the administration of *Silicea* were, first, that the patient was *scrofulous* and *rachitic;* and second, that in the provings of Silicea we find "*constant violent pain in the great toe,*" "*frequent boring pain in the great toe,*" "*ulcerative pain in the great toe, also with stinging pain,*" "*constant violent pain in the great toe, so that he can scarcely step.*"

The patient frequently spoke of having the feeling that there was matter in the toe, the discharge of which would give relief, and hence, in studying the remedy, it occurred to me that it was possible for a proving of a drug to exhibit a subjective symptom like "ulcerative pain of the big toe," and be curative to such symptom without objective ulceration existing in the part at all.

But the curing of such a case in this way is not quite satisfactory. If it were possible to trace out the etiology, pathology,

and diagnosis of such cases as the two I have mentioned, and connect the curative measures with them by a chain of logic, the feeling of satisfaction at their recovery would be immensely enhanced. I have not been able to do this satisfactorily.

1. *In Regard to the Etiology.*—This is, in my judgment, in the constitution of the parents, and hence heredity is the chief factor in the etiology. All the children of the parents of the second case have been more or less rachitic. Scrofulous swellings have been more or less common in the family. Curvatures of the spine, as we have seen, have been developed by two of them. All the children are feeble. The parents seem pretty sound people, not robust, perhaps, but able to show a good record of work. The mother thinks she had something like a curvature when she was young, of which she was cured, and is now bright and well. So that while we are unable to indicate in the parents the exact dyscrasia which should produce the results we see in their children, we are safe in ascribing these results to the physiological relation existing between the father and mother. All their children are scrofulous.

2. *The Symptomatology.*—There was dysmenorrhœa, irregularity, and unsatisfactoriness of menses, a good deal of general disturbance at each menstrual period; there was the persistent pain in the ball of the left great toe, aggravated at her catamenia; there was a good deal of nervous prostration. These symptoms pointed to a uterine condition, which held a causal relation to the trouble in her great toe. The symptoms were largely the same in both cases, but I am now referring mainly to the last case, which I was able to follow.

3. *The Diagnosis.*—The intimate relation existing between the pain in the tissues of the toe and the uterine functions would point to the uterus as the *causa morbi* in the case; and this is confirmed by the fact that *pari passu* with a subsidence of pain in the toe, came entire relief to the dysmenorrhœa, the irregularities in her menses, and the general prostration. It was not spinal disease in any of its multiform aspects. The spine seemed now quite sound to palpation, and the concomitant symptoms usually accompanying myelitis, myelasthenia,

or neurasthenia were wanting. It was no form of rheumatism with which I am acquainted, and no rheumatic remedies had any curative effect. It had none of the peculiar characteristics of neuralgia; the pain was steady and continuous. It had neither the swelling nor the redness of gout, nor the terrible suffering of that disease. It was not abscess, for pus was never shown by any of the usual signs, chill, or fluctuation. But there is an anatomical and physiological nervous relation between the uterus and the tissues of the great toe, and to this fact I ascribe the trouble in this case. It was, in short, a case of reflex pain.

In fact, the uterus holds such a pivotal relation to all the muscular and nervous systems of woman, that it seems wise to seek in this organ for many of the disturbances of function resulting in disease, which we are called upon to treat. These disturbances are frequently remote. The headaches preceding, accompanying, and following the menstrual molimen are so common as to pass almost unnoticed. The gastric disturbances, especially during the early stages of gestation, are common and well known. It not only sympathetically disturbs organs remote from it, but it seems occasionally to transfer its functions to other organs. Vicarious menstruation on the part of the lungs, when the uterus is too weak to do its duty, is one of the instances of this kind of vicarious work. But it is not only from the uterus that such reflex results are witnessed; certain irritable strictures of the urethra have been found accompanied with severe neuralgic pain in the heel. A common and well-known instance is the incontinence of urine from the presence of ascarides in the rectum, and no treatment will cure this incontinence while the ascarides remain in the rectum. Vomiting as a reflex symptom is constantly seen. Irritation of the hepatic nerves by the presence or passage of a biliary calculus; irritation of the renal nerves by a calculus imbedded in the pelvis of the kidneys, or passing through the ureter; irritation of the vesical nerves by inflammation of the bladder; irritation of the pharyngeal branches of the glosso-pharyngeal, as in the old-fashioned process of tickling the throat with a feather.

All these things may produce vomiting, and in each instance the symptom is a reflex one. In the cases before us, may not the persistent pain in the ball of the great toe have been one of the numerous instances in which an irritation in one organ was the cause of a serious disturbance of function in a distant region? For instance, the nerves which are distributed to the womb are derived partly from the cerebro-spinal nervous system and partly from the great sympathetic. The nerves from the great sympathetic system come from the inferior hypogastric plexus, and have filaments associated with them from the third and fourth sacral; thus connecting the uterus with a large portion of the tissues of the body. Pressure upon a sensory nerve—or sensory filaments of a nerve—from a point of congestion, for instance, in the body of the womb, would be quite sufficient to initiate a sensation which would be transmitted to the nearest nerve-centre; which, in this instance, would be the hypogastric plexus of the sympathetic, from which, through some of the communicating branches from the cerebro-spinal system, connected with this plexus, the sensation is carried to the posterior column of the spinal cord. From this centre the first reflex movement may be said to occur. Then what is a reflex movement? It may be stated as the effect produced by an impression upon a sensory nerve, transmitted by that nerve to a nerve-centre, and reflected from that nerve-centre along a motor nerve. Thus, it will be seen that an impression, made originally upon a sensory nerve, may, by this reflex capacity of the nerve-centres, be converted into a powerful motor influence, and if this influence be sufficiently strong it may be manifested in the form of clonic or tonic spasms. In the case before us the reflex movement must have sprung from the posterior column of the cord to the anterior or the antero-lateral column, and from hence along the sacral nerves till it reached the sacral plexus, from which point, through the great sciatic, the internal popliteal, the posterior tibial, and the internal plantar, it is carried directly to the tissues forming the ball of the great toe. The subversive influence thus carried to this region produces disturbances of

nutrition, and these disturbances make an impression upon the sensory filaments of the nerve trunks which conduct to the spinal cord, and the sense of pain is thus carried back by the spinal cord to the brain.

But I must beg, before concluding what I have to say about these cases—and I fear you all think I have already said more than the importance of the subject required,—to call your attention to one feature of the treatment. It will be seen that the single drug which cured this case has no reference, in its pathogenesis, to the uterine symptoms seen in the case, and upon which, in my judgment, depended the whole pathology of the case. The prescription was made entirely upon the symptoms exhibited in the remote effects of this pivotal trouble, and not at all upon any pathological or physiological theory. It seems to confirm the Hahnemannian theory that if your drug cures the salient *symptoms* of a case, you may safely expect that the *cause* of those symptoms is cured with them.

Article XIV.

ELECTRICAL STUDY.

BY H. L. GODDEN, M.D., WARSAW, ILLINOIS.

The study of electro-therapeutics is one of the greatest of modern studies, because it embraces so many others within its scope. One reason why electricity is so often thrown one side as useless, or even harmful, is that it has been studied in too limited a manner. The collaterals on which it depends have been neglected. The fact is, however, that electrical study presupposes a more or less thorough study of chemistry, mechanics, and so much of metallurgy as pertains to the properties of the different metals and substances used as elements and electrodes.

When the ascent is made to the therapeutical uses of electricity, the knowledge before required is still necessary, and

also much more; not only in the branches mentioned, but also in new ones.

Every well-read practitioner is versed in anatomy, physiology, and pathology; few, however, are versed in these branches as related to electricity. I have already given something of the requirements for the electro-therapeutist in the *Counsellor*, October, 1879, to which I would refer. In this I will try and give some idea of what is required in the way of apparatus for successful practice, and also how a part, or all, such apparatus can be had for a very reasonable cost.

First, as to the battery. We want two kinds, galvanic and faradic. We will consider the faradic first. The market is flooded with these, and it is quite a task for one to make a selection unless he has had a good deal of experience and has made quite extended experiment with different instruments. I will make but one remark more in regard to the choice of a faradic battery, and that is, I have been much better satisfied with those instruments which give rapid interruption, say twenty to fifty per second, and of these the multiple coils are probably the best. The current should be perfectly steady and free from fluctuation.

It is also well to have cells of different intensity for a faradic instrument, so that a very energetic primary current can be obtained, or one of lower intensity but equal quantity, by using a different cell of lower electromotive force. I use a Kidder battery, except the Kidder cell, for which I have substituted one using a carbon negative, with cast zinc positive in electropoion fluid, and also a rather large zinc-carbon cell if a more energetic current is wanted. I have not time to enter into the reasons for this arrangement further, but am ready to discuss the subject with any one who wishes, either privately or through this journal.

Now we come to the harder task of getting a galvanic battery; but here is one advantage, that there are fewer to select from, and that few are desirous of getting a battery of this kind except those who have paid sufficient attention to the

subject to know what they want; also writers are universal in their preference for the Daniel or some of its modifications. These are probably the best for everything except for electrolysis. A very important consideration, however, is the size of the cell and what kind of attachments shall be put on to the battery.

Theoretically the most complete battery, suitable for all kinds of work, would be large gravity cells with a wire rheostat attached. Practically, however, I do not think this quite "fills the bill," but does very well. My own battery is of small gravity cells, and for the most part it gives very good satisfaction, but requires more care than larger cells would.

For electrolysis a zinc-carbon battery is the best; almost any of the various portable batteries are suitable for this kind of work, though not for therapeutics.

Now, a little as regards the setting up and care of a battery. If any one wishes to make his own battery it can be done quite cheaply, or he can go to as much expense as he pleases. A battery of sixty cells can be gotten up for $10, with commutator, galvanometer, rheotrope, and hand interrupter, all in good practical shape (it takes study and work to do it though). Or it may be made to cost all the way from $50 upwards.

The same is true of electrodes; they can nearly all be made if a person has time and ingenuity.

There is one reason why I would advise every young electrotherapeutist to make at least a small battery, and that is, that the study required to do it will give him the mastery of his battery to an extent that nothing else will.

In choosing a galvanometer the resistance of the body should be taken into the account, and one chosen which is sensitive enough to show some deflection when two or four cells are used, and the body being interposed between wet electrodes.

I make this requirement for a galvanometer because of the varying resistance of human bodies, not only in different individuals but in different parts of the same person. This varying resistance does not amount to so much with the faradic

current, which has very high tension and but very little quantity. But in the galvanic apparatus, where quantity is great and tension comparatively small, it is of the greatest importance to have a galvanometer which will show the intensity of current passing through the patient with every gradation, from the smallest number of cells to the highest.

The needle should be carefully watched at all times during a sitting, as if perfectly understood it will afford many valuable bits of information in regard to diagnosis and treatment.

Electro-physiology, electro-pathology, and electro-diagnosis are very simple and plain terms, but they serve to point out three fields of which very little is known, especially the latter. I think electricity in one form or other will yet be the final test to which every case of doubtful diagnosis will be brought for determination. In this we must be aided by the rheostat, and no less by the galvanometer.

The study of electro-therapeutics is capable of development far beyond any other branch of medicine, but its development depends more on the observation and experiment of energetic men, who are not tied down to any theory or dogma, than on those who are willing to follow where others lead, or go ahead on "general principles." I know of one man who treats all cases by passing a current from a galvanic battery from the back of the neck to the feet, or *vice versa*. This generalizing will not do, cases must be individualized.

Let us exchange ideas on the subject, and stir up new and original thought, as it is only in this way that advance can be made. More anon.

ARTICLE XV.

POSTERIOR SPINAL SCLEROSIS.

A THESIS FOR ASSOCIATE FELLOWSHIP OF THE NEW YORK MEDICO-CHIRURGICAL SOCIETY.

BY EDGAR V. MOFFATT, B.S., M.D.

SYNONYMS.—This disease is known by a variety of names, as: 1. Progressive Locomotor Ataxia; 2. Tabes Dorsalis; 3. Tabes Dorsualis (Romberg); 4. Leuko-myelitis Posterior Chronica; 5. Progressive Motorial Asynergia; 6. Ataxie Locomotrice Progressive (Duchenne); 7. Sclerosis of the Posterior Columns of the Cord, or Posterior Spinal Sclerosis (Hammond); 8. Gray Degeneration, or Degenerative Atrophy of the Posterior Columns (Friederick), etc.

Of these titles, *Progressive Locomotor Ataxia* comes mainly from *one symptom*, which often arises years after the disease is well established. *Tabes Dorsalis, i. e.*, consumption or wasting of the cord, is vague and unsatisfactory in every way, but is sanctioned by long usage.

Gray Degeneration, or *Degenerative Atrophy of the Posterior Columns*, is far better, as it shows the pathological condition and localizes the lesion.

Posterior Spinal Sclerosis is the best of all titles, for it shows the lesion which lies at the root of all, or nearly all, of the conditions, and locates the morbid process. Sclerosis in nerve tissue passes over to *gray degeneration;* both are true names; but sclerosis is preferable as showing the primary cause (as nearly as is known) of the rest of the lesions and functional disturbances.

HISTORY.—The disease was in a measure known to Galen and Hippocrates, but remained shrouded in comparative obscurity until the early part of the present century (1820–30), when its anatomy and pathology were more accurately studied; but even then theories were vague and conflicting; the so-called *Tabes* really including many other nervous diseases.

The German scholars now gave it close attention, so that Romberg, and later Wunderlich, in 1854, presented us very accurate pictures of the disease. Duchenne in 1858 wrote an exhaustive work on "Ataxie Locomotrice Progressive," claiming it as a new disease, and locating the seat of lesion in the cerebellum, whereas it was long before known to reside in the spinal cord.

His treatise was admirable, provoking free investigation and discussion, bringing especially the French profession to the front.

In 1863 the Germans again claimed the field by advancing the views of Leyden, Friedreich, and other prominent scholars; so that now, with a few important additions from English and American authors, the literature of posterior spinal sclerosis presents a rich field for investigation.

Much is still obscure in its pathology, and also in its therapeutics; but each year the advances in physiology and pathology render our knowledge more exact, while the ever-increasing resources of *homœopathy* give brighter promises for the therapeutics of the future.

DEFINITION. (Mainly after Erb, Ziemssen's *Cyclopædia*).—Posterior spinal sclerosis is a chronic spinal disease, usually lasting many years, sometimes decades.

The lesion is a gray degeneration of the posterior columns of the cord, produced by sclerosis or hyperplasia of connective tissue, and consequent atrophy of nerve-fibre.

This begins in the external portion of the posterior columns, advances transversely, often implicating the columnæ graciles (or wedge-shaped columns of Goll) and the lateral columns; probably, later, the posterior horns of gray matter are involved.

It usually commences in the lumbar region and ascends, sometimes to and including, the medulla oblongata. It rarely begins in the cervical region and descends.

It presents three stages, indistinctly marked however, and varying greatly in different individuals:

Stage I.—Lancinating pains; degeneration of optic and

motor oculi nerves; anæsthesia and varying forms of paræsthesia, as pain, sense of a tight girdle, numbness, formication, etc., of the feet, legs, trunk, and sometimes the region of the ulnar nerve. Motor disturbances, as, very easily induced fatigue; feeling of uncertainty in the legs; weakness of the bladder and sexual system. This stage rarely is completed in a few months, but usually lasts many years.

Stage II.—Includes the major part of the above symptoms greatly intensified, and constitutes the fully developed disease.

The lancinating pains have subsided, but the feeling of uncertainty in the legs has increased to actual *ataxia*. Ataxia consists in the loss of the co-ordinating power in voluntary movements, without, however, loss of vigor in the muscular contractions.

Stage III.—And final, is that of progressive spinal paralysis. There is actual paralysis of voluntary and involuntary muscles (markedly of the bladder), muscular atrophy, contractures, bedsores, marasmus, and *death*, sometimes from asthenia, sometimes from intercurrent maladies, as dysentery, pneumonia, etc.

Friedreich's variety differs from the ordinary in origin and symptoms. It will be described under the head of *symptoms*.

ÆTIOLOGY.—The neurotic temperament is the one great *predisposing* cause of nervous diseases. Prominent among these stands posterior spinal sclerosis.

Though little can be said of its hereditary origin, yet a tendency to it may sometimes be traced in a line of descent.

*Friedreich** has shown this in a series of families in which several members of each were attacked. These differ so markedly from the ordinary type that we recognize the *Friedreich form of tabes.*

Dr. Marius Carré† cites a family in which eighteen members were ataxic in turn, viz., the grandmother, mother, all the mother's relatives (eight in number), besides seven children and one cousin.

* Ziemssen's Cyclopædia, vol. xiii, pp. 533 and 593.

† Dr. Marius Carré, quoted in Trousseau's Clinical Medicine, vol. i, p. 200.

In general, however, heredity has little apparent influence. It is principally a disease of youth and middle age, the great majority of cases occurring between thirty and fifty. Males are far more liable than females.

The two most prolific causes are taking cold, especially when fatigued, and sexual excesses. This last may in part account for the preponderance of male patients. In regard to sexual excesses authorities vary somewhat. Hammond does not seem to give them a very important status.* Erb argues ably, and claims for them a leading influence. He considers onanism and excessive venery to be very exhausting to the nervous system, and especially to the spinal cord, which, when thus weakened, is quite liable to take on the disease should a predisposition or other cause present; while frequently these excesses are enough in themselves to act as exciting cause. Professor Lilienthal, with other writers, considers the sexual excesses not the cause, but the *effect* of the already existing spinal disease, which produces irritation of the sexual system.

Syphilis and certain other acute and chronic diseases, as typhus, intermittent fever, diphtheria, etc., traumatism, physical and mental overwork, habitual bursts of passion, long-continued standing in a constrained position, or exposure to inclement weather, suppression of foot-sweats, excessive alcoholism, and the inordinate use of tobacco, are all given as important causes; but with all these, a great number, and even perhaps the majority, of cases of posterior spinal sclerosis show no assignable cause; that is, they are *idiopathic.*

PATHOLOGICAL ANATOMY.—*Macroscopic Appearances.*—On opening the spinal canal evidences of a meningitic complication are sometimes seen in a thickened and clouded pia mater, bands of adhesion to the cord, particularly in the posterior region, and at times bony plates in the pia mater. In case the cord be much atrophied the spinal fluid will be found increased in quantity.

In the cord itself, however, are seen the essential lesions of the disease.

* Ziemssen's Cyclopædia, vol. xiii, p. 149 et seq.

In a mild case, and the early stage, a mere whitish ribbon-like band may be seen and felt in the *outer part of the posterior columns,* not implicating the columnæ graciles.

The rest of the cord is normal.

This condition is usually most marked at the lumbar enlargement, and diminishes both upward and downward.

More advanced stages of the disease show the posterior columns shrunken, of a yellowish-gray color, and somewhat translucent. The sclerosis has invaded the columnæ graciles, which are much atrophied; and at a later stage sometimes softened.

It is not at all uncommon to find the posterior nerve-roots and posterior horns of gray matter degenerated, being gray, atrophied, thin (the roots sometimes like mere threads), and more or less translucent. But great as may be the degeneration of the posterior roots, the sensitive nerves beyond the ganglia are always found intact.

The anterior roots are normal.

The degeneration process not infrequently invades the lateral columns to a slight extent, and as a rare complication even the anterior columns are markedly sclerosed and degenerated.

When this occurs, the whole cord is hard, shrunken, gray, and somewhat translucent; and on transverse section the "H" of gray matter scarcely discernible. This condition only obtains in the last stages of exceptionally severe cases; and as it embraces the whole transverse section of the cord does not belong strictly to the pathology of *posterior* spinal sclerosis. It is only mentioned to show what ravages the disease and its complications sometimes make.

Certain cranial nerves, as the optic, motor oculi, abducens, and hypoglossus (rarely the last, and still more rarely the 5th), show a degeneration substantially the same as that in the cord, whether macroscopically or microscopically observed. In the optic nerve the degeneration may extend from the eye to the corpora geniculata.

The muscles are unaltered in structure, except in the last

stage,—that of paralysis and atrophy; here fatty degeneration sets in to a marked degree.

In rare cases of this disease a singular affection of the joints is met with, in which there is extensive serous effusion. The whole limb for some distance above and below the joint, and the joint itself, are very œdematous, but there is no pain either on active or passive motion.

Resolution may ensue, but the process usually continues. Then the articular extremities of the bones and the cartilages disintegrate, the ligaments are destroyed, luxations and subluxations result, and the joint is incurably damaged.

It attacks, in the order of frequency, the knee, shoulder, elbow, and hip.

The appearance of bedsores, cystitis, etc., in the last stage may be regarded as complications, and are merely mentioned here as such.

Microscopic Appearances.—It may be well just here to say a few words about the neuroglia and then of "Gray Degenerations," for by a clear understanding of this process, and by locating the changes in the posterior columns, posterior horns of gray matter, and posterior nerve-roots, we may obtain a fair picture of our many-named disease.

The neuroglia in the spinal cord has been variously regarded by different authors. They all agree as to its being a connective substance, abundantly distributed in the white and gray matters as a support and cement for the nerve fibres and cells and for the vessels.

But as to its histological construction there is a great diversity of opinion.*

The generally accepted view is, that it consists in a mass of connective tissue cells, called Dieters's cells, with numberless twining and anastomosing processes.

Other high authorities consider it a fibrous tissue *containing* numerous connective-tissue cells. Rindfleisch claims the neu-

* See Rindfleisch's Path. Histol., p. 653; Gerlach, Kölliker, Walther, Henly, and Merkel in Stricker's Manual of Histol., pp. 626 and 627; Boll in Ziemssen's Cylopædia, vol. xiii, p. 22.

roglia to be a granular protoplasm-like amorphous cement, in which a fibrous structure appears as the result of pathological action, or from the use of reagents in microscopic preparation.

Thus whatever view we adopt as to its histology, all agree that it is, or becomes at the onset of sclerosis, a fibrous scaffolding for the nerve fibres, and in this tissue is probably found the primary seat of the gray degeneration. From some cause hyperplasia of this tissue appears, with hypertrophy and proliferation of Deiters's cells.*

This growth induces pressure on the nerve fibres, which consequently atrophy; first the medullary sheath degenerates, and later, often after a long resistance, the axis cylinder. Sometimes a few isolated and shrunken axes are found late in the disease in the midst of a mass of sclerosed neuroglia.

Corpora amylaceæ are very abundant, especially in that tissue which has been longest invaded, and along the tracks of the larger vessels.

They are supposed by Rindfleisch† to be neuroglia cells which have undergone amyloid degeneration, and not concretions or new deposits, as some have supposed.‡ Fat-globules are also abundant. The vessels show a lustrous, white, sclerosed, and slightly thickened adventitia, but no change of striking importance. The degenerated parts are quite vascular.

The effect of the whole process is to produce a somewhat shrunken, grayish, translucent appearance in the part affected.

The invasion of the posterior horn of gray matter may

* According to Rindfleisch this form of gray degeneration is not of inflammatory origin. Another variety shows sclerosis in smaller and more or less isolated patches. In the centre of each of these is a marked vascularity, sometimes indeed with extravasation. This is evidently sclerosis of inflammatory origin, and is seen in multiple sclerosis.

† Rindfleisch's Path. Histol., p. 656.

‡ Green's Pathology, 1, Morbid Anatomy, p. 78. He considers them new formations of essentially different nature and origin from amyloid degenerations, and gives his reasons.

readily occur, being largely composed of the "gelatinous substance of Rolando," which is for the greater part neuroglia.

The fibres of the posterior roots passing into the posterior columns, would naturally be subjected to the processes already active in the column, hence their atrophy; and the degeneration once being established in the roots, it extends outward in their track, but never beyond their ganglia. I have not seen any explanation offered for this limitation; and the only one which presents itself to me is not liable to this form of sclerosis. The neurilemma and connective tissue matrix of the ganglion are of fine *fibrillated connective-tissue* with no special cellular structure; whereas the neuroglia is of *reticulated tissue*, with a plentiful supply of Deiters's cells.

It is not yet certain that the cord is primarily and the roots secondarily affected, though many observers claim this to be the case. Professor F. S. Bradford advances the theory that the perineurium of the posterior roots exterior to the cord is first diseased; this affects their nerve tissue and the degeneration extends into the posterior columns, which are thus secondarily affected.

As already mentioned, certain cranial nerves undergo the same degeneration, and some authors claim to have found changes in their nuclei of origin in the fourth ventricle.

As yet no anatomical connection has been traced between these nerves and the degenerating cord.

SYMPTOMS AND PATHOLOGY.—The symptoms vary essentially, especially in the early stages, according to the portion of the cord affected, the previous health, temperament, etc., of the patient, and the extent to which the sympathetic is involved. Prominent in the introductory stage are the characteristic "*lancinating*" or "*electric*" pains. These are so constant and severe that this period is often called the "neuralgic stage."

The pains are variously described as *paroxysmal, intense*, darting, tearing, boring, and shooting; flashing "like lightning" through the legs, trunk, and rarely the arms and head. They are sometimes aggravated by fatigue and the least moral

emotions. The pain is often mistaken for rheumatism, being paroxysmal and aggravated by changes of weather, especially cold, thunderstorms, rain, or snow, and *at night.* They are constantly shifting in locality, sometimes feeling like a knife or red-hot wire thrust through the part, sometimes described as a red-hot knife thrust into the flesh, and then twisted about; at others the limbs feel as if tightly squeezed in a vice.

The pains frequently follow nerve tracks, along which the skin is hyperæsthetic during an attack. They are often relieved by a strong pressure, but aggravated by a light touch. Sometimes they lie deep in the soft tissues or bones. Very often they are simply compared to heavy or light *electric shocks* through the system.

Frequently the pains are preceded by a dull (and sometimes but slight) aching pain in the back. In rare cases there is an aura rising from the stomach or genitals. The paroxysms appear at first for a few seconds or minutes, say once a month, then every week, increasing in severity till they become almost constant, as twenty times an hour.

This terrible agony sometimes continues for months or years. The pain may be unintermitting, or in paroxysms of a single dart, the patient being quite free and comfortable between the attacks. Generally they are seen only in the first stage; sometimes they continue through the second, and rarely they appear in the later stage, with or after the marked ataxia.

The disease may remain thus for a period of years without any further symptoms arising.

These pains are supposed to arise from the pressure of advancing sclerosis upon the fibres of the posterior roots within the cord.

The pains will predominate in certain regions, according to the location of the lesion in the cord.

Very rarely there appear in this stage paroxysms of intense gastralgia and attacks of pain resembling renal colic, only

they last longer. Both are supposed to be related in some way to the lancinating pains.

Very early in the disease may be noticed *loss of reflex action of the tendons*, shown by failure on the part of the quadriceps extensor, for instance, to contract, as in health, by a tap on its tendon just above or below the patella. This is stated by some to be a very early, constant, and important diagnostic mark, and should always be looked for.

Reflex action of the tendons in the lower extremities is supposed to be maintained by a spinal centre situated in the lumbar enlargement; this is implicated by the advancing lesion in the cord, and its function suspended.

A similar centre is thought to preside over the tendon of the triceps extensor, but is located in the lower cervical or upper dorsal region, so a like test may show the lesion in that part of the cord.

Sometimes the initial symptoms are of a cerebral character, as vertigo, headache, heaviness in the head, vomiting, ptosis, disturbances of vision, and, rarely, epilepsy or epileptiform attacks.

Again, they may be referred to the digestive system, as nausea, vomiting, diarrhœa, obstinate constipation, etc.

At times they appear on the general surface, as anæsthesia, paræsthesia, analgesia, hyperæsthesia, etc.

As the manifestations vary so it may be well to choose a certain order of invasion, and mention all the important symptoms, not as any hypothetical case, but as a means of picturing the *disease as a whole.*

In this first stage we may have, but rarely, temporary partial paralysis, as hemiplegia, paralysis of the tongue, of the third and sixth nerves, still more rarely, perhaps, of the auditory, or anæsthesia of the fifth, giving insensibility of the mucous membrane of the eye, nose, mouth, teeth, skin of face, etc.

Sometimes after and sometimes long before the lancinating pains appear *ptosis* and *strabismus* with consequent *diplopia,*

from temporary paralysis of certain muscles of the eye, most frequently those governed by the motor oculi.

Amblyopia.—This is far more serious, and coming as it does from gray degeneration of the optic nerve, eventuates in a usually hopeless *amaurosis.*

This may often be recognized by the ophthalmoscope, which shows the optic disk undergoing white atrophy.

The amblyopia is accompanied by a narrowing of the field of vision, and is preceded by color blindness, losing perception of colors generally in the order, green, red, yellow, and blue.

Protrusion of the ball and dilatation of the pupil occur if the lesion in the cord be above the inferior cilio-spinal centre, which lies in the upper dorsal region.

Trousseau mentions some cases in which between the attacks of intense pain, the conjunctiva was deeply injected and the pupil powerfully contracted to the size of a pin's head, or sometimes its point, and resisting even the action of Atropia. Then during an attack the congestion of the conjunctiva disappears and the pupil markedly dilates.

He advances no theory as to the cause or the pathological condition present. It would seem to me to be due to disease of the cord involving the inferior cilio-spinal centre, situated in the cord between the sixth cervical and second dorsal nerves.

Impairments in its functions, other things being equal, contracts the pupil by paresis of the radial fibres of the iris. The paresis being of central origin would naturally resist the action of Belladonna, which is purely local, that is when instilled into the eye. Very probably from the same condition of paresism of the vasomotors of the conjunctiva we have the marked congestion noted above.

Now during a paroxysm there is excitation in the cord at the seat of lesion, producing irritation of the cilio-spinal centre noted by Flint* and others.

Had the case been more fully reported there would prob-

* Flint's Physiology, vol. v, pp. 102 and 103.

ably have been found some derangements of accommodation which might have supported this view. Anæsthesia, paræsthesia, etc., are very common conditions, and may be mentioned here, though they sometimes precede or accompany the lancinating pains. If the lesion in the cord be in the lumbar region, the evidences will be marked in the lower extremities; if in the lower dorsal, it is shown principally about the abdomen; if in the upper dorsal, at the chest; if at or above the origin of the brachial plexus, the upper extremities and certain muscles of the thorax will be most affected; if the upper cervical and medulla be degenerated, the results are far more serious, involving derangements of the heart, of respiration, of swallowing, etc.

Thus the trouble is manifested chiefly at or below the distribution of the nerves arising from the diseased portion of the cord. The functions of parts below the lesion are normal as far as reflex phenomena are concerned, but are impaired insomuch as they depend on the conducting power of the diseased portion of cord above.

To return to the paræsthesia. If, as is by far the most common, the lumbar region of the cord be affected, the evidences of disturbed sensibility are such as burning, numbness, and formication in the legs and feet; feeling as though stepping on felt, velvet, or air-cushions, and of felt between the toes (all from incomplete anæsthesia of the parts); numbness; the toes feel too large for the shoes; burning pain in the soles; the feet and legs "go to sleep" easily; sometimes the patients feel as if walking on sticks.

These sensations may be produced by irritation of the posterior roots at their entrance to the columns, together with, perhaps, a drilling of the perception of touch from the disease in the cord.

All grades and kinds of anæsthesia may be present, yet cases are reported in which there was no sign of anæsthesia to be found.

Analgesia is frequently present, sometimes associated with unimpaired sensibility to touch; sometimes, however, there may

be profound insensibility to touch or pain, but a ready and sometimes even exalted perception of temperature, and this is usually the most persistent.

Sometimes any or all of these conditions may be present in varying combinations, and transmission of the impressions to the brain be retarded.

They are sometimes conveyed with varying rapidity. Cases are reported in which, when the foot was pricked, the *touch* of the needle was perceived at once, but the pain was not felt for seventeen seconds in one case, and in another (reported by Hammond*), *for three minutes.*

Other and much longer intervals than these are cited by authorities.

Sometimes complete anæsthesia exists, not only of the surface, but of the deep structures, as bones, muscles, joints, etc.

The cause of the above phenomena probably lies in the impaired conducting power of certain portions of the cord. Some authorities claim that the perceptions of temperature, touch, pain, etc., have different paths of conduction in the cord, so that localized disease in the cord may affect some and not others; but these tracks are not yet minutely defined, though the posterior columns are shown to contain the paths of conduction for tickling, touch, pressure, and temperature.

If the lesion be high in the cord a similar set of symptoms is referred to the upper extremities, and particularly marked is a sense of burning and formication in the distribution of the ulnar nerve.

A very common form of paræsthesia is the so-called "girdle pain," which is a sensation of constriction, sometimes with great pressure, described variously,—as from a string, a tape, a garter, a broad bandage, or sometimes even as from a coat of mail. This girdle pain may occur anywhere on the extremities or trunk, varying with the location and extent of lesion in the cord.

It is thought to arise from a slight irritation of the posterior

* Diseases of the Nerve System, p. 485.

nerve roots, which enter the cord at or about the *upper edge of the seat of lesion.*

In uncomplicated cases there is no strongly marked pain or tenderness in the region of the spine. If such be present, particularly sharp intense pains, aggravated by carriage-riding, etc., with tenderness on pressing the spinous processes, a meningitic complication is evident.

In this stage we find marked excitement of the sexual system, particularly, if not exclusively, in males. The desire is very strong, indeed sometimes apparently insatiable. Trousseau reports cases in which there were eight to ten connections every twenty-four hours. Erections and emissions are frequent. Then follow sexual irritability and weakness, with trembling and excitement from the touch of a woman, premature ejaculations, etc.

In the great majority of cases, disturbances connected with the motor functions now appear, especially a sense of weakness and *fatigue*. The vigor of an individual muscular act is not materially diminished, but the power of endurance rapidly lessens till the patient is unable to walk, lift, or exercise to any extent, on account of the sense of exhaustion which so readily supervenes. Patients now experience an uncertainty in voluntary movement. They feel a swaying sensation on standing with the feet close together, and sometimes sway perceptibly, *especially on closing the eyes.* This condition is known as "static ataxy," and constitutes an important diagnostic mark of the disease.

The muscular sensibility becomes perverted, or more usually diminished, or wholly lost; so that a patient is unconscious of the condition and position of an affected limb, unless informed by the sense of sight.

To this cause is also due the inability to estimate weights. The normal hands can differentiate between weights as 39 : 40; but in this disease, 1 to 2 ounces, 1 ounce to a pound, or sometimes even weights as 1 : 100 cannot be distinguished.*

* Späth in Hammond's Dis. of Nerve Sys., p. 491.

It is impossible in our limited space to enter satisfactorily into the argument as to the functions, or even the existence of the much-debated " muscle sense."

Trousseau* believes in muscular sensibility, but not in the sense of muscular activity; *e. g.*, a decided sensation is felt in a strongly contracted or a wearied muscle; but in ordinary motion, as of the fingers, no sensation is referred to the forearm.

Hammond† endeavors to prove that no such sense exists, but I think he fails to successfully controvert the numerous and weighty arguments and authorities on the opposing side.

The general reflex excitability is much diminished, while irritability of the muscles to the electric current is greatly increased. This is a constant and important diagnostic mark.

More positive signs of motor disturbance now appear. The swaying above referred to (the *static ataxia*) increases, sometimes even to the point of falling when the eyes are closed. Symptoms of locomotor ataxia now appear, and develop more or less rapidly. They appear in the great majority of cases first in the lower extremities.

In certain cases there is a constant tremor of the affected limbs, like that of paralysis agitans.

Thus we see the first stage has merged imperceptibly into the second, the division being more for convenience of description than actual tangible steps in the disease.

The invasion of ataxia is usually gentle, affecting first the most complicated movements; but it may be sudden and violent, with comparatively few premonitory symptoms.

When referred to the lower extremities it is impossible to execute such movements as describing an even circle, then touching a given point with the foot. It cannot, without difficulty, be guided to a small space, like the step of a carriage. The movements are zigzag, and overshoot the mark. If the eyes be closed or withdrawn the movements are still more wild and uncontrolled.

* Trousseau's Clinical Med., vol. i, p. 159 et seq.

† Hammond's Dis. of Nerve Sys., p. 503 et seq.

Or sometimes the first intimation of the disease is an inability to walk or stand steadily in the dark or with closed eyes.

The *gait* becomes very irregular and highly characteristic. The eyes are kept fixed on the ground a little in advance of, or on the feet. The leg is brought forward with a hurling motion, thrown a little out from the median line; the knee stiffened, the foot brought down with a jerk not far from where it was lifted, the heel first, then the toe, with two distinct sounds.

In turning around, the patient stops, then slowly and carefully turns by swaying the body and arms. Often in crossing a room they will balance themselves, and after carefully estimating the distance and aim, start on a wild ungainly run and hurl themselves forcibly against the desired wall, table, or chair, and hold on, perhaps for a fresh start.

This difficulty increases so that a cane, then crutches are necessary; finally, on attempting to walk, the patient falls to the ground.

This all arises from lack of co-ordinating power.

At this stage the muscular power is intact. The power to resist passive motion and the strength of grip are unimpaired; and a man who could not stand alone has been able, when supported by the arm of a friend or with his hand and eyes on a railing, to carry three men around the room on his shoulders. This is a well-authenticated case.

When lying at rest, as in bed, no ataxia is present, it only occurring with voluntary movement.

Sclerosis more rarely, or much later in the disease, attacks the cervical cord, and is shown by disturbances of sensibility and ataxia referred to the upper extremities.

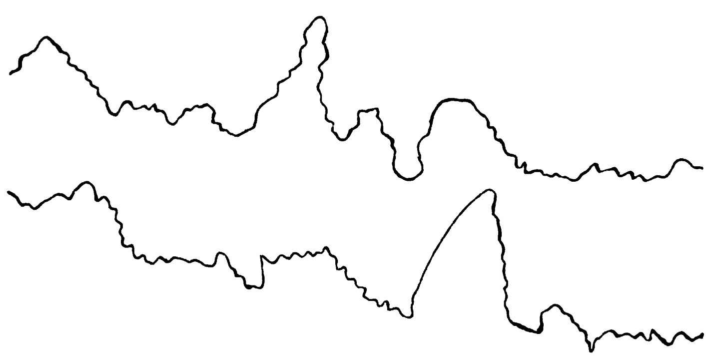
The invasion here too is usually gradual, first numbness, formication, etc., in the fingers, hand, and arm; cannot pick up a pin or a small coin; fingers feel as if covered with velvet, and a train of symptoms similar to those enumerated above in connection with the feet.

Writing, playing the piano, and similar complex move-

ments become impossible; then the patient cannot button his clothes. He cannot hold a small object, but as yet can handle a large one easily. Soon all his movements have to be regulated by the eye; on raising a glass of water to the lips, for instance, if he do not keep his eye upon it, it falls from his hand. With closed eyes he cannot guide his finger to a given spot, even on his face.

Ataxia not only prevents harmonious action of the muscles, but the patient cannot estimate the force of contraction necessary to a given end.

If the lesion be in or below the dorsal region, the line of the dynamograph, as drawn by the hand, will be nearly straight, but if in the cervical, implicating the origin of the brachial plexus, the tracing will be quite irregular, as represented.*



The upper line is the drawing of the right, and the lower of the left hand.

The patient in tracing these, felt confident, until shown the result, that he had maintained a steady and equal pressure on the instrument.

In the ordinary form of posterior spinal sclerosis the ataxia rarely attacks the tongue; but when it does so, produces an irregular, somewhat stuttering speech.

In the "Friedreich form" of the disease, however, this is far more common.

* Hammond's Dis. of Nerv. Sys., p. 492.

Should the muscles of the eye become ataxic, there will be an irregular jerking form of nystagmus, only seen on trying to fix or direct the gaze.

If the eye be closed or at rest, the ball is quiet, the vacillating only ensuing on voluntary motion.

Through all this we see how constant and invaluable is the help derived from the sense of sight. What then can be sadder than the development of amaurosis, leaving the patient to endure his ever-increasing sufferings in total darkness?

A curious phenomenon is the aggravation which the blind often experience in closing the eyes. Before this time, if the lesion be in the lower dorsal or lumbar region of the cord, troubles of the bladder will have appeared, as difficulty in micturition, dribbling after the act, and sometimes incontinence to a varying degree, etc., all pointing to paresis of the bladder.

The sexual excitement before noticed gradually gives way to weakness, irritability, premature ejaculations, emissions without erections; then weak, flaccid, cold organs, and varying degrees of impotence, with usually extinction of all sexual desire. In women there is generally but little disturbance of this function; menstruation, pregnancy, and the puerperium being all normal.

The disease of the joints has already been alluded to. It comes from the spinal disease, which paralyzes the trophic nerves, as it were, thus destroying the nutrition of the joint.

But why the nutrition of the joints should suffer so, while that of the body in general remains so good, is an unsolved problem. For, in spite of the severity of the disease, so far the patients are usually plump, fresh, and well nourished, the muscles are large, firm, and powerful, yet in any complicated effort less efficient than a child's.

The mind all through the disease to the last is clear, and the majority of sufferers are very patient and cheerful, considering all they have to make life a fearful burden.

The disease may stand at this stage for years or even decades,

with intervals of improvement; but usually its progress is slow, sure, and irresistible to the *third* and *fatal stage*.

The ataxia subsides, or rather succumbs to advancing paralysis, and contracture or paralysis of the lower extremities appears. If the lesion be high in the cord, this paraplegia affects the upper half of the body. The paraplegia is probably due to invasion of the lateral columns.

The plump firm body emaciates, and the legs (if not already wasted from disease) atrophy, the muscles of the body undergo fatty degeneration, and marasmus sets in.

The bladder, weakened before, and by this time catarrhal, becomes paralyzed; the urine decomposes in it, producing cystitis with its attendant evils.

The rectum and sphincter are paralyzed, so that involuntary and unconscious defecation occurs, which helps the formation of bedsores in the almost devitalized tissues.

Finally, if no intercurrent malady terminates life, the patient usually dies of asthenia.

This concludes the symptomatology of the typical form of posterior spinal sclerosis.

Of course one case will present all these symptoms, many of which are quite rare; but I dwell on them not only to make the description as complete as possible, but to draw attention to other conditions than the ataxia, which some writers seem to consider the exclusion of nearly all other symptoms.

Reference has been made to the "FRIEDREICH FORM OF TABES." A few words will describe it. It has a marked hereditary origin. "In a series of cases reported by Friedreich* the father of four of the patients was a confirmed drunkard, and the wife gave it as her opinion that the children were begotten while he was intoxicated." So much for aetiology.

The pathology is not yet well determined.

* Schmidt, Jahrbücher, Band cxxxiv, 1867, No. 4, quoted by Dr. McClatchey in Transactions of the New York Homœopathic State Society, vol. vii, 1867, p. 178.

The symptoms are in great part just the reverse of those in the ordinary type. This will be seen as I quote and condense from Ziemssen.*

It prevails between the ages of twelve and eighteen; attacks females especially. Lancinating pains rare in the beginning; well-marked ataxia at the outset, which extends rapidly to the upper extremities, or sometimes arising in the upper and lower extremities simultaneously. Co-ordinatory disturbances of speech and ataxic nystagmus common. No disturbance of sensibility, or if any be present it occurs late, and is insignificant. No swaying on closing the eyes; no bladder troubles or bedsores; no amaurosis. Paresis and contractures, muscular atrophy and weakness of the bladder appear only in the latest stages. Duration of the disease is remarkably long—over thirty-two years.

This form of the disease is of course rare.

In regard to the pathology of the symptom *ataxia*, there is great diversity of opinion. Leyden, Hammond, and other eminent authors claim the perversion and loss of sensibility as the cause of ataxia.

But well-authenticated cases are reported in which ataxia was marked, but anæsthesia absent; others showed profound anæsthesia, but no ataxia whatever, at least none synchronous with the anæsthesia. Some, as Jaccoud, Carré, and Cyon, consider it to arise from deranged conditions of reflex action within the cord; while Erb and Friedreich hold that it springs from a lesion in the co-ordinating tracts, which lie, it is supposed, in the posterior columns of the cord.†

The centre of co-ordination may be intact or destroysd; we cannot tell, for its situation is unknown. It was supposed, and some few still hold, that it resides in the cerebellum; but Hammond‡ shows conclusively the unsoundness of this theory.

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* Vol. xiii, pp. 593 and 594.

† Woroschiloff shows that *in the rabbit* these paths of conduction lie in the middle third of the lateral columns, and do not touch the posterior columns. But this is no conclusive evidence as to their position in the human subject.

‡ Hammond, op. cit., p. 501.

Others, as Golton, place it in the corpora quadrigemina and optic thalami. Some say the gray matter of the cord, but no one *knows* just where it is.

Wherever the centre may be, pathological investigations go to show that the paths conveying co-ordinating power lie in the posterior columns, so when they are diseased, the influence can no longer reach the muscles, and *ataxia* is the result.

This is the leading theory at present, but advancing physiological researches may soon disprove it, for much is still vague concerning the functions of the spinal cord.

DIAGNOSIS.—The diagnosis of the typical or the Friedreich form of locomotor ataxia is easy; but both are liable to many complications, as meningitis, the different forms of chronic myelitis, etc., thus sometimes requiring a careful differentiation.

Chronic transverse myelitis (common) may be distinguished by the absence of lancinating pains and ataxia; by the presence of motor paralysis and anæsthesia appearing at an early stage, and having a sharp line of demarcation at its upper border.

Contractures, spasms, and greatly heightened reflex irritability are marked in myelitis.

Hysteria, according to Da Costa, may closely resemble posterior spinal sclerosis, probably from anæmia of the posterior portion of the cord; but may be distinguished by its history, general anæmia, absence of lancinating pains, and recovery.

Cerebellar disease may somewhat simulate ataxia; but Hammond* clearly points out the distinctions.

In the former the disturbances are due to vertigo, hence the patient is greatly *relieved* by closing the eyes. Ataxia is very much aggravated thereby.

In cerebellar disease there is great occipital headache; and the gait is like that of a drunken man (from the vertigo), not abrupt and jerky as in ataxia.

(TO BE CONTINUED.)

* Hammond, op. cit., p. 497.

Gleanings from Foreign Journals.

ARTICLE VII.

ON THE ELECTRICAL EXCITABILITY OF THE SKIN.

("BRAIN," JULY, 1879.)

BY S. TSCHIRIEW, M.D., ST. PETERSBURG, ETC., WYLIE TRAVELLING FELLOW OF THE IMPERIAL ACADEMY OF MEDICINE, ST. PETERSBURG, AND A. DE WATTEVILLE, M.A., LONDON, ETC. (ASSISTANT PHYSICIAN TO THE HOSPITAL FOR EPILEPSY AND PARALYSIS, REGENT'S PARK).

THE object of the following pages is threefold. First, to indicate the conditions which any rational method must fulfil which pretends to give us accurate results as to the electrical excitability of the cutaneous nerves; these conditions will be found to depend partly upon the behavior of the electrical current, partly upon certain anatomical peculiarities of the skin. Secondly, to criticise in the light of the principles set forth the chief methods hitherto proposed to estimate the electrical sensibility. Third, to propose a new method, more simple and rational, and state some of the results already obtained from its application.

I. According to the general law of excitation of nerves, formulated by Du Bois-Reymond, this excitation depends upon *rapidity* with which the electrical density changes in the nerve, and not with the *absolute value* of that change.

Hence we ought, for measuring the electrical excitability of a nerve, to determine the rapidity of change in the density necessary to excite it; and this is what Dr. v. Fleischl's* ingenious instrument, the rheonome, enables us to do. Only such measurements are much too complex to be of any practical clinical value. It is, however, possible to attain the same object by simpler means, through the elimination of some of the variables in the experiment. Thus if the current is made through the nerve with always the same rapidity, so that it reaches its maximum intensity in the same space of time, we

* Untersuchung über die Gesetze der Nervenerregung, III. Abhandlung. Stzber. d. k. Academie der Wissensch. zu Wien. Vol. lxxvi, part 3, p. 138.

may measure the excitability of the nerve by the density of the current flowing through it. Or, again, if the diameter of the nerve remains constant, its excitability may be estimated by the strength (intensity) of the current.

It is easy to base upon these considerations a rational method for measuring the electrical excitability of the skin. This would consist in giving the galvanometric value of the currents necessary to produce the minimum sensation in every part of the skin, provided that these two conditions are observed: (1) the make and break of the current must be made every time with the same rapidity; (2) the surface of contact of the electrode with the skin must always be the same. It is evident that by using this method we are independent of all the variations in the resistance, permanent or incidental, originating in the parts to be examined. Let it be clearly understood, however, that we assume here a direct galvanometric measurement of the current strength, and not an estimation of it by resistances introduced either in the circuit itself or in a derived current.*

Given two points of the skin of different electrical resistance, we must, to obtain the same current-strength in both cases, use a different number of elements. Once the same current-strength obtained, the excitation is the same in both cases, provided always the other conditions be fulfilled, *i. e.*, equal rapidity of make and break, and equal extent of excited surface. Now it is clear that, under such circumstances, if the excitability be the same, the effect of the excitation must be the same also.

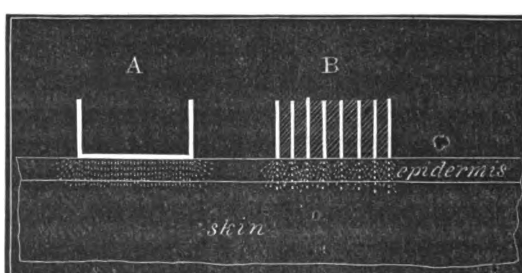
By these means, then, we are made independent of the source of error pointed out frequently before, and arising from the variable thickness of the epidermis. Yet, in order to be able to measure the excitability, not of the collective nervous elements of the skin, but of the cutaneous nerves themselves, we must be able to eliminate the sources of variation arising

* The latter process, so often employed by electro-therapeutists, after the example of Brenner, ought to be entirely abandoned. Applied in researches, such as those we have described, for instance, it would give entirely erroneous results.

from the structural differences of the nervous supply in different parts of the skin.

We have, it is true, no direct anatomical demonstration of such differences; but physiological observations, such as the measurements with E. H. Weber's compasses, allow us to suppose that the number of nervous endings in a unit of cutaneous surface varies in different parts of the body. If this supposition be true, it necessarily follows that an electrode of the same surface applied to different parts of the body ought to produce excitations of various strengths merely on account of the variable richness of the skin in nerve-endings.

The way to eliminate this source of error consists in always exciting the skin at the same number of points by means of a special form of electrode. The simplest would be a pointed electrode which would eliminate the influence of a variable number of excitations by reducing this number to a minimum; but its sharpness would make an accurate estimation of the minimal electrical excitatioh difficult. The following form of electrode, however, satisfies the present condition sufficiently well; it consists in a small cylindrical bundle of well-insulated wires; and it is not difficult to understand the important difference between the effects of such an electrode and those of one in the shape of a solid cylinder of the same diameter.



The figure makes this difference evident. The excitation produced by B will be stronger than that produced by A, because the surface of the metallic contact with the skin is less, and hence the density of the current greater. Again, and this

is the important point, the number of the excitations in the case of B will be more uniformly the same, whilst in the case of A it will depend upon the abundance of cutaneous nerve-endings. For it may be assumed that with B none but the shortest currents from the wires through the epidermis will stimulate the nerves; that is, none but the nerve-fibres lying nearest to the wires (the points of greatest electrical density) will be stimulated, especially as we here deal merely with minimal excitations. We shall see further on that experience has completely borne out these theoretical considerations.

There is yet a condition that has not hitherto been attended to in testing the sensibility of the skin, and which must, however, have some influence on the results of the experiments. One of us (Dr. Tschiriew) in a paper forthcoming in the *Archives de Physiologie* (Charcot, Vulpian, and Brown-Séquard), starting from physiological and pathological data, shows that it is necessary to assume the interruption of all the centripetal paths in the gray matter of the spinal cord, and that the differences in the duration and intensity of the excitation necessary to produce the same effect may be explained by the variations occurring in that interruption among the several afferent nerves. Hence it follows that, in order to eliminate differences due to any such variations possible among the afferent cutaneous nerves, it is necessary to allow a certain duration to each excitation.

In order to fulfil this condition if the continuous current were used, and also to avoid the mechanical and electrotonic influences of this current upon the tissues, we should require an apparatus which would interrupt the current, and at the same time reverse it each time, at a uniform rate of speed. This obviously complicates the process so much as to make it inapplicable for clinical observation. But before we pass to the description of a simpler and more practical method we must say a few words on those hitherto proposed, and examine how far they fulfil the conditions just laid down.

II. In 1864 Munk and Leyden (Untersuchungen über die Sensibilität im gesunden und kranken Zustande, Virchow's

Archiv, vol. xxxi, page 1) described the following method for testing the electro-cutaneous sensibility. A pair of wooden compasses were fitted with metallic terminations connected with the secondary coil of a Du Bois-Reymond's induction apparatus. The points were fixed at a constant distance from one another (1 cm.), and applied to the skin. The sensibility was then determined by noting the distance between the two coils when the point of minimum sensation was reached. Simple make or break induced currents, of constantly the same rapidity, were used. This method led its authors to the following results: (1.) Different regions of the skin differ in their absolute sensibility in much the same degree as in their sense of space (Weber).* (2.) The electro-cutaneous sensibility decreases in the following order: face, trunk, upper arm and thigh, elbow and knee, tips of fingers and toes.

The authors themselves define the value of these measurements by adding that the local thickness of the epidermis, as well as the local abundance of nerve-fibres, must influence the results obtained. This method is, indeed, faultless if our object is merely to determine the electro-sensibility of the skin as a whole, with all its incidental peculiarities, such as the varying thickness of its epidermis, abundance of its sensitive elements, conductivity of its subjacent structures, and mode of interruption of its afferent nerves in the spinal cord. For it is admissible that in every healthy individual the *distribution* of these anatomical peculiarities of the skin in its different parts follows the same law. On the other hand, it would be impossible to draw any conclusions whatever from results obtained by this method about the sensibility of the cutaneous nervous elements themselves, since these results have been obviously modified by the various conditions just enumerated.

Bernhardt (Electrotherapeutische Notizen, *Deutsches Archiv für Klinische Medicin*, 1877, vol. xix, page 382), whilst ob-

* This hardly agrees with the results obtained by the authors themselves; the tips of the fingers, for instance, are more developed for the sense of space than the trunk.

jecting to the foregoing, the practical difficulties in the comparison of results obtained with different induction apparatus, proposes the following method: to measure the electro-cutaneous sensibility by the resistances which must be intercalated in a derived circuit in order to reach the minimum sense of pain. The *modus operandi* is as follows: The patient holds the positive electrode of a battery of thirty Stöhrer's elements in his left hand. The sensibility is tested by means of a wire brush connected with the negative pole. A derived current is established through a rheostat, and the resistances read off as soon as pain is experienced. These readings give the measure of the sensibility.

This method offers no advantage over that of Munk-Leyden; the results obtained even for the same individual are hardly comparable among themselves. The relations between the variations in the rheostat resistances, and the current strengths thus set up through the body, are obviously far more complex than those between the distances of the coils and the strength of the induced currents in a non-graduated apparatus. Besides, given the number of cells included in the inducing circuit, and the number of turns of wire in both coils, the true value of the distances between the two coils noted in any experiment can at any time be ascertained; whereas the value of the rheostat resistances could be determined only by the repetition of all the measurements upon the same person, and by a process the complexity of which is in itself greater than the graduation of an induction apparatus.

Again, the determination of the minimum sensation obtained on exciting by a single make or break of a continuous current, owing either to the longer time it takes to attain its maximum intensity or to the electrotonic influences it exerts upon the tissues, is much less precise than that produced by the induced current. This is easy to demonstrate upon oneself. The matter becomes of still greater importance when we have to do with patients whose intelligence is not always of the keenest. We may also recall the well-known phenomenon explainable by the electrotonic effects of the galvanic current:

that, when we think we have reached the minimum current strength that will produce sensation, we find, on controlling the experiment by further diminishing the current, sensation will now manifest itself to much weaker stimulations than at first.

But the greatest objection to Bernhardt's method is the fact that the resistance of the body included in the circuit varies with every new position of the negative electrode, a source of error which he gives us no means to remedy. As an instance of the results he obtains, we may quote the following measurements: for the tip of the nose, from 50 to 60 Siemens's units,* intercalated resistance sufficed; whereas 2000 to 3000 Siemens's units were necessary for the tips of the fingers and toes! As to the general conclusions reached by the author, they agree with those of Munk and Leyden. He, too, refrains from drawing any as to the irritability of the cutaneous nerves themselves.

The current number of the *Archiv für Psychiatrie* contains a paper by Drosdoff (Untersuchungen über die electrische Reizkarkeit der Haut bei Gesunden und Kranken, vol. ix, part 2). The highly elaborate form in which these researches are presented compels us to pay more attention to them than their intrinsic value deserves. Some of the objections raised by the writer to the previous methods are either utterly groundless or have been anticipated by their authors themselves. Thus, for instance, when he objects that the results obtained by Munk and Leyden are vitiated by the varying abundance of nerve elements in the skin, he forgets that, so far from falling into such an error, these authors had pointed out this fact as forbidding them to conclude from the sensibility of "the skin" to that of "the cutaneous nerves." This does not prevent Dr. Drosdoff from falling into it himself, though, judged from his own standpoint, the method he uses is still more defective than that of the above-named authors. Like Bernhardt, he fixes

* Siemens's unit of resistance is equal to .97 ohm nearly.

one of the electrodes on some part of the body (the sternum), and explores the sensibility by means of the other electrode in the shape of a wire brush. He uses a non-graduated induction apparatus, and estimates the sensibility by the distance between the two coils, like Munk and Leyden. This method is thus merely a combination of the two former ones, from the imperfections of which it does not escape. It unites the limited applicability of the first (Munk-Leyden) to the weakest point of the second (Bernhardt), in that it introduces a different resistance into the circuit with every change of position of the exciting electrode. Neither do the results obtained by Drosdoff differ materially from those of the previous observers. In order, however, to find out whether the differences in the sensibility discovered in different parts of the body are not simply due to differences in the resistance of these parts, the author has made numerous measurements of what he calls "epidermic resistances." For this purpose he fixes one of the electrodes of a battery of twelve Stöhrer's elements on the sternum, and applies the other to the various parts of the body, the sensibility of which has been tested. A galvanometer with 150 turns of wire is introduced in the circuit, by the readings of which the resistances are estimated. Now it is evident that it was the resistance of the whole portion of the body included between the electrodes and not that of the epidermis that the author was measuring. Again, if the instrument used was a simple sine-galvanometer, and was not graduated in absolute units,—and he says not a word on this important point,—it is evident that his measurements did not correspond to the absolute value of the electrical forces. As it is, one is struck at first sight by the parallelism between the series of numbers obtained by the resistance measurements and those obtained by the sensibility measurements at different points of the body; but, strange to say, the author draws from them the following conclusion: that there is no relation between the differences of resistance and of sensibility of the same points. Let the reader judge for himself. At page

213, under the title of Electrical Zones, we find the following numbers:

M.S. . .	232.5	212.0	200.7	193.3	154.2	188.1
M.P. . .	165.2	156.5	146.4	142.3	123.6	142.3
Dev. . .	22.2°	9.3°	6.9°	4.5°	2.5°	6.5°

And at page 215:

M.S. . .	184.6	184.2	178.1	138.8		
M.P. . .	143.0	140.0	133.0	117.6		
Dev. . .	7.1°	5.3°	3.4°	2.9°		

M.S. stands for minimum sensation; M.P. for minimum pain; Dev. for deviation in degrees of the needle. Each vertical column of numbers corresponds to one of the author's zones. These numbers are means of ten observations, and therefore have a higher intrinsic value than each of their component factors. The parallelism which we observe among them is quite as marked as what we could expect from the imperfect method used and the peculiarities of human bodies.

The way Dr. Drosdoff escapes the conclusions forced upon him by his own data is to pick out among the individual factors a few exceptionable numbers in which the parallelism does not exist; and from these exceptions, due probably to unavoidable errors of observation, he concludes that there is no such thing as a relation between the variations of the resistance and of the sensibility. Further, upon this extraordinary conclusion, the author bases another assertion of still higher import, and which he gives as the grand result of his investigation, viz., "that the differences of sensibility at different points of the skin are due to differences in the excitability of the nerves themselves." We shall state evidence further on to disprove the author's conclusions, from the results of our own experiments. They are far from being deducible from his own measurements, and, indeed, it would seem that he has con-

spicuously brought into evidence the great influence variations of resistance have exerted upon the results obtained. Elsewhere he is led astray by his ignorance of the properties of the instruments he used. He says (page 219): "The difference ('Verhältniss') between the minima of sensation and those of pain varies between 6 and 88 mm. (mean: 11–73.6) distance between the two coils. These distances diminish, in the case of painful impressions, with the increase of current strength." This statement is false if by it is meant that there is any relation between the two kinds of sensation; for the author's results have been obtained with a non-graduated apparatus, and is ascribable to the mere absence of proportionality between the distances of the coils and the strengths of the corresponding currents.

III. From what we have said, it is clear that the method of Munk-Leyden is sufficient for measuring the sensibility of the skin; and that none of the methods hitherto proposed enables us to test the electrical excitability, absolute or relative, of the cutaneous nerves themselves.

We have pointed out previously a rational method for accomplishing this object. But, as we saw, though correct, it is too complex to be applicable to clinical purposes. We have, however, another one to propose, which is simple, though fulfilling all the conditions which have been laid down previously. We now pass to the description of this method, and of the results we have been able to obtain by its application.

Its principles are the following: (1) Elimination of all the sources of variation in the strength of the currents due to the variable thickness of the epidermis,* and the different positions of the electrodes, etc., by intercalating in the circuit such re-

* This condition has often been held up as very unfavorable to the appreciation of the sensibility of the cutaneous nerves, and it is thought that were that thickness known at various parts of the body much could be gained thereby. We hold the opposite view; for if we cannot eliminate by the method itself the influence of the epidermis, how can we hope to be able to do so by calculation when we are acquainted, ever so precisely, with its thickness at every part of the body?

sistances as to make such variations insignificant; (2) Elimination of the influence of the variable abundance of nervous elements in the skin by exciting it at a constant number of points disposed over a constant surface. The latter is effected by using the form of electrode described previously, and composed of a solid cylinder of insulated wires.

In order to fulfil the first condition, it was necessary to know what resistance the human body could offer in such experiments. The measurement of these resistances is far from being such a simple process as is commonly thought. The conditions of experimentation from which they are obtainable are so various as to make it impossible to speak absolutely of the electrical resistance of a part of the body, but only of its resistance under this, that, or the other condition. For instance, according to the details of the process of experimentation adopted, the "resistance of the forearm" may vary from about two to forty (or more) thousand ohms. The main circumstances influencing the results are: (1) the size, shape, and moisture of the electrodes; (2) the pressure with which they are applied; (3) the strength of the currents employed; (4) the condition of the parts tested, *e. g.* the degree moisture of the epidermis, the previous application of a more or less strong current, etc.

The first circumstance is of easy explanation. The fact that resistance diminishes with the pressure exerted upon the electrode is not so satisfactorily accounted for. It is more readily observed in parts of the skin with a compressible, rather than a hard, subjacent tissue. The electrical resistance may be diminished, on increasing the pressure by one-half, two-thirds, or even more.

The variations dependent upon the current strength are illustrated by the well-known fact that when first applied to the skin a current ftom a large number of elements may be weak, but soon becomes stronger, showing that the patient's resistance diminishes. This diminution must be, partially at least, explained by the cataphorical effect of the current (Du Bois-Reymond) by which liquids are conveyed into the integuments

either from the electrode or from the subjacent tissues. Hence, weak currents must be used for measurements in order to eliminate this source of error. The fourth condition referred to above may also be reduced to the increased moisture of the integuments. The following experiment will illustrate it. An electrode is fixed to the back, and another applied to the dorsal surface of the forearm. The resistance is found to be about 10,000 ohms. After a little rubbing of the arm with the electrode, and a strong current, resistance is found to have sunk below 3000 ohms. The practical outcome of all this for measurements of body resistances is that, first, all the conditions of observation must remain the same throughout; second, all these conditions must be carefully described in every case. If these requisites are not fulfilled, the data obtained cannot have the slightest value.

Our measurements were taken as follows: A metallic plate, 5 × 12 cm., covered with wet wash-leather, was fixed to the upper part of the back; the various parts of the body were explored with a metallic disk 7 mm. in diameter, also inclosed in wet wash-leather. The latter electrode was fixed to a Eulenburg's baræsthesiometer, in order to insure the same amount of pressure everywhere. The pressure used was of 150 grams. The skin at the point of application was moistened, and the time taken for each observation restricted to a few seconds, in order to avoid differences arising to the unequal imbibition of the epidermis. Several observations were taken for each region, but the electrode was never reapplied to exactly the same spot, or only so after some time had elapsed. The battery used was a Gaiffe-Leclanché, and the number of elements used (4–14) chosen so as to obtain at every part a weak current (.2 to .5 milliveber),* and to avoid the disturbing effect of strong currents on the tissues. The following table gives our own resistances in ohms.

* A current of one milliveber is that obtained with one volt through one thousand ohms. The electromotive force of a Daniell's cell is nearly one volt.

	Ohms.	Ohms.
Tip of nose,	12,000	8,100
Forehead,	4,000	3,000
Cheek,	8,200	6,400
Forearm (post),	18,750	14,000
" (anter.),	20,000	———
Hand (dorsal),	21,000	15,500
" (palmar),	42,000	48,000
Tips of fingers,	65,000	46,000
Leg,	21,000	23,000
Foot (dorsum),	22,000	24,600
" (sole),	80,000	50,000
Tips of toes,	60,000	60,000

These numbers hold only for limited areas of the regions investigated. The different portions of the leg, for instance, tested under the same conditions throughout will vary in resistance according to the peculiarities of the epidermis and subjacent tissues. Similar measurements made with the electrode used in testing the sensibility (a cylindrical fasciculus of insulated wires) gave still more considerable differences, especially with the dry skin. In this way the resistances of the tips of the fingers and toes may amount to 100,000 ohms and more.

Hence we see that in order fully to eliminate the influence of the body resistance in investigating the sensibility on Bernhardt's principle, at least a two million ohms' resistance is to be introduced in the circuit; and it is easy to perceive how much this author's and Drosdoff's results must have been influenced by these sources of fallacy, which they have ignored.

For the investigation of the sensibility, our method consisted in fixing a large neutral plate electrode on the back; and in using as differential or exciting electrode a metallic wire brush, of which the wires were insulated with sealing-wax, and brought together to form a cylindrical bundle of 75 mm. diameter. Care was taken that the exciting surface was as

smooth as possible. This electrode was mounted on an interrupting handle. A Du Bois-Reymond's induction apparatus, fed by two Bunsen's cells, was used. The secondary coil (600 meters of 0.225 mm. copper wire) was used, and in the circuit included a resistance of upwards of three million ohms, formed by a slip of vulcanite overlaid with a film of plumbago. The hammer of the apparatus was made to vibrate at a rapid rate, and the current closed by means of the key through the previously applied electrode. This is a most important precaution, as "dabbing" the skin with the current on would produce such variations in the density of the current as to vitiate all the results. The minimum point of sensation was sought by adapting the distance between the two coils, whilst excitations were made by making and breaking the current by means of the key, the electrode remaining immovable *in situ*. Finally sufficient time was allowed for each excitation.

In this way we have arrived at very unexpected results. In opposition to what has been stated by previous observers, we have found that *the electrical excitability of the skin, or rather of the nerves of the skin, is the same at every part of the body*. There always occur slight differences (amounting from a few mm. to 1 cm. of coil); but on the one hand these differences are not always in the same sense, on the other their absolute value is too small* to claim any special signification.

Several points must be attended to in order to obtain reliable data with our method. (1) The elements feeding the coil must be *constant* (this excludes Leclanché's, and all single fluid cells, such as Stöhrer's, Smee's, etc.). We used two Bunsen's. (2) The conducting wires must be thoroughly insulated from every surrounding object, owing to the enormous

* Though the curve representing the relation between the distances of the two coils and the current strengths corresponding to these distances is entirely independent of the resistances in the circuit of the secondary coil, the absolute value of these currents is *not* independent of these resistances, which appear in the curve as one of the parameters. Since then, in our experiments where the circuit included an intercalated resistance of several million ohms, the variations of 1 cm. or less in the coil distances can correspond but to very small variations in the current strengths.

"tension"* of the current. (3) As before mentioned, the excitation must begin after the electrode is *in situ*. (4) The portion of skin tested must be moistened. At first sight this last condition appears superfluous; for how, it is asked, can the hygrometric state of the skin have any influence when the circuit contains already such an enormous resistance?

We venture to offer the following explanation of this phenomenon. It is not due to any change in the resistance of the skin; because such a change would, as objected, be of no appreciable influence under the circumstances, and because also—a fact opposed to such a supposition—dry skin is more excitable than moist skin. But, as it has been experimentally shown (Tschiriew, Ueber die Nerven- und Muskelerregbarkeit, in Du Bois-Reymond's *Archiv f. Anat. und Phys.*, 1868, p. 494), electricity distributes itself, in a transverse section of every conductor it passes through, always in an inverse ratio to the resistance (Kirchoff's law), *independently of any resistance in the circuit.*

Hence even in our experiments, where several million ohms' resistance was included in the circuit, even in the case of the dry skin, where we must assume differences of resistance between the dry epidermis and the sudoriparous ducts, the whole current would find its way through the points of least resistance. Hence, a current, which on a moist skin would have been hardly felt, may become even painful on a dry one. It is a well-known fact that the excitation of the dry skin produces a pungent sensation; of the moist skin a milder sensation—the latter being more evenly diffused than the former. Again, this difference is less marked in some regions than in others; for instance, less at the finger-tips than on the cheek or dorsum of hand. Hence appears the importance of eliminating this source of fallacy.

Another capital precaution in sensibility testing is to avoid placing the electrode on any nervous twig. The peculiar sen-

* De Watteville, On the Nature of Electrical Tension, in the Medical Times and Gazette, September, 1877, and Medical Electricity, chap. i.

sation evoked will tell us if it has been done; and as a rule we must always choose the least sensitive spots for exciting. Generally speaking it will be advisable to avoid those spots where the epidermis is very thick; this latter condition would involve not only a higher resistance, but also a greater thickness of the layer interposed between the nervous elements and the electrode, and thus increase the diffusion of the currents before they reach the nerve-endings. In order to illustrate the influence of the kind of electrode we use (cylindrical bundle of insulated wires) in eliminating the influence of the variable abundance of cutaneous nerve elements, we have compared its effects with those of a solid cylinder of the same diameter (7 mm.). With the former, as above related, we found the excitability of every part of the body practically the same. With the latter, we found it different, and to a certain extent varying in the same ratio as Weber's sense of space. Thus:

	cm.		cm.
Nose,	7.0	Hand (palm),	5.0
Forehead,	7.2	Tips of fingers,	8.3
Lips,	7.3	Leg,	3.0
" (red part),	5.3	Foot (dorsum),	4.0
Forearm (front),	6.6	" (sole),	0.0
" (back),	5.2	Tips of toes,	7.5
Hand (back),	5.5		

In the interpretation of these data, however, it must be noted that we used a non-graduated induction apparatus, fed by two Leclanché's, with several million ohms' resistance in the circuit. We have seen before that the absolute strength of induced currents diminishes in an inverse ratio to the intercalated resistance. Hence the absolute value of the excitations corresponding to the coil distances just given is much less than if the body alone had been included in the circuit.

The different results obtained from the use of the two forms of electrodes can be explained only by the fact of the varying nervous supply of different regions of the skin, and the elimination of its influence in the case of the special electrode.

Another observation we have made in the course of our experiments, and which illustrates the importance of the shape of the electrode in exciting the skin, is, that if the bundle of insulated wires was made into an elliptical instead of a cylindrical column, the results obtained depended upon the relative position of its long axis with reference to the prevailing direction of the subcutaneous nerves. If the long axis coincides with this direction (as, for instance, in the limbs in the direction of their length) the excitation produced is less powerful than when it is transverse to the general course of the nerves. The same result is observable when a solid elliptical electrode is used.

This fact does not disprove our assertion about the possibility of eliminating the influence of the relative abundance of nerve-elements in different parts of the skin by our electrode. For, besides the arguments derived from comparative experiments, it is hardly possible to conceive such a regular distribution of nerve-endings in the skin that a mere alteration in the direction of the electrode should be followed by a change in the number of the endings influenced. We must assume, then, that we have here to do with a new factor of influence in the measurement of sensibility, viz., the mode of division and subdivision of the subcutaneous nerves.

An analogous phenomenon is observed with Weber's compasses. If at the same spot the minimum distance of distinct impressions is sought in various directions, it is found (especially in the limbs) that these distances are greater in a parallel than in a transverse direction to the main course of subcutaneous nerves. Hence Weber's "circles" are ellipsoids, with their long diameter directed along those nerves.

The explanation of this phenomenon is, that when the long axis of the electrode coincides with the main direction of the

nerve-trunks, the larger number of exciting points influence the terminations of the same system of ultimate fibres of some one nervous twig. If, on the other hand, the long axis of the electrode is directed transversely to the nerves, the number of excited points of each twig will be less, but the number of those twigs stimulated will be greater.

Hence it will be observed that, for testing the sensibility, electrodes with a circular surface of contact are alone to be used in order to eliminate this disturbing factor from the results.

The advantages of the method we have adopted are, that it is simple, easily applicable in clinical investigations,* and that its results, to be understood, do not require any comparison with tables of the distribution of sensibility in different parts of the body. As an example of its application we subjoin the results obtained in a case of bulbar paralysis with lateral sclerosis. All the tendon-reflexes were exaggerated, especially on the right side. The sense of touch was nowhere greatly impaired, but there was decided diminution of the sensation to pain, on the right side especially.

* In order to facilitate the application of our method, we are endeavoring to produce an appropriate electrode. Our present model is to consist of a tube of non-conducting material containing in its upper part a rod of resisting substance—kaolin and graphite—of two million ohms; in its lower a cylinder of metal, the extremity of which forms the exciting surface. This surface will be subdivided by a system of intersecting grooves, filled with an insulating substance, into a number of exciting points, as shown in the diagram already figured. This little appliance, mounted upon an ordinary interrupting handle, will be all that is required, besides an induction apparatus with a moderately long and fine secondary wire and a constant element.

Part of Body.	Distances of Coils.	
	Right.	Left.
Nose,	6.0	7.2
Forehead,	6.1	6.5
Cheek,	4.3	5.5
Back (lower dorsal),	0.5	3.6
Arm,	4.0	5.6
Forearm (back),	3.5	5.3
" (front),	3.7	4.5
Hand (back),	2.2	4.6
" (palm),	>0.0	0.0
Tips of fingers,	3.2	5.5
Leg,	0.0	5.0
Foot (dorsum),	0.0	3.7
"	>0.0	0.0
Tips of toes,	>0.0	>0.0

The same induction apparatus as previously was used, with two Bunsen cells. In the circuit a resistance of more than three million ohms was intercalated.

THE AMERICAN JOURNAL

OF

ELECTROLOGY AND NEUROLOGY.

JOHN BUTLER, M.D., Editor.

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Editorial.

WHY is it that so many physicians have been ready to rush into print—into the columns of the daily press—with their opinions of the value of electricity as a means of inflicting capital punishment? So ready to prostitute one of the most valuable remedies in the treatment of disease, into a means of taking the lives of their fellow-men; so ready to prostitute their own acquired attainments and talents, given them for the purpose of healing sickness, allaying pain, and promoting the happiness and welfare of mankind; so ready to belittle *themselves,—physicians!*—to play the role of executioner?

Have we not enough of scientists to attend to this kind of dirty work (if it be deemed still necessary to inflict the death penalty) without physicians soiling themselves and lowering their calling by their interference in the matter? Our calling is to *prevent* the approach of death as far as lies in our power, whether the patient be criminal or not, and not to cause it; and we therefore have nothing whatever to do with any means of inflicting death. What, then, is the object of the individuals who have voluntarily put themselves and their views on this subject into print in the daily papers? To show the public that their taste lies more in playing executioner than in the practice of their profession? or to exhibit (as some of them have) how little they know of electro-physics as applicable to either department? or to get the kind of equivocal notoriety

that their names in print would naturally give them with the thoughtless and ignorant? If they had any of these objects in view we congratulate them on their decided and triumphant success; but do not think that they have in any way added to the honor and dignity of the profession to which they belong.

So far we have only seen articles from one physician deprecating the use of electricity for the purpose in question, and we cannot but regret that the subject was not in abler hands. His arguments (if such they may be called) are based upon wrong premises, show entire unfamiliarity with the subject of electro-physics, and are so utterly absurd that they are beneath criticism.

We have no sympathy whatever with this movement.

We consider the infliction of capital punishment to be morally wrong,—an imitation of the very crime which we condemn; for, if it be wrong for any one man to take another's life, it is equally so for any number of men to do so, even though they may have the law of the state or country on their side.

One of the greatest political economists, John Bright,* says:

> "If the death penalty is of any force, in any case, to deter from crime, it is of much more force in lessening our chief security against it; for it proclaims the fact that kings, parliament, judges, and juries may determine when and how men may be put to death by violence; and familiarity with this idea cannot strengthen the reverence for human life."

Fernando Wood† says:

> "The abolition of capital punishment could have no other than a salutary effect. Life would become more sacred, and hence more secure. When society itself sets the example of treating human life as a thing lightly to be taken, men become familiar with its little value. Following this example, they often take it from others without compunction.
>
> "In my judgment, neither the law nor the individual has the right to take human life. It is a sacred creation of the Almighty, not to be extinguished by force or violence."

* Christ and the Gallows. Marvin H. Bovee, p. 79.
† Ibid. p. 76.

Horace Greeley* gave his opinion of capital punishment in the following words:

> "*I hate vengeance.* If I am ever revengeful, I hate myself for being so. Vengeance is a barbarous, cruel, malignant passion, which I would not teach *my* children or *any* children. The gallows *does* teach it; always did teach it. The boy who runs to see a man hung will be taught thereby to seek to injure every one he deems his enemy. . . . I would affirm and inculcate as widely and impressively as possible *the* sanctity of human life. . . . I believe that legal executions incite to, rather than diminish, murders."

Are the physicians who rush into print with their new, improved, and ready method for taking human life, likely, by their increasing familiarity with their hellish devices and contrivances, to become imbued with an increase of reverence for the sanctity of life? or are they likely to value it more lightly than before? The old proverb, "Familiarity breeds contempt," is as true here as ever it was. We certainly would not like to be a patient of one of those men, and, no doubt, the thinking portion of the public are of the same mind.

We have no sympathy with the movement; for we do not wish to see the remedy that has proven such a boon to suffering humanity made to take the place of the hangman's rope or the executioner's axe.

We have no sympathy with the men who would make it do such duty, and regret exceedingly that any of the medical profession have countenanced the matter.

We hope sincerely we have heard the last of it; but, if the legislation of the country must have it, let it employ men in no way connected with our noble profession to attend to such work.

THEORIES based upon facts are the guiding stars in the practice of medicine; while theories, founded upon hasty conclusions, deductions made from insufficient evidence, the sem-

* Op. cit. pp. 99 and 100.

blance of facts, or a fertile imagination, are stumbling-blocks in the progress of science, and do much to retard research. This is especially so when these theories are hobbies ridden by high authorities, whose *ipse dixits* are too often mistaken for law by the more credulous of the profession. Medical journals should, therefore, be scrupulously careful that they admit no articles into their pages upholding false theories, except these theories be put forward for the sake of provoking argument and discussion, and do not come in the shape of dogmatic assertion. We have too many of these already. The very latest comes from the editor of the *Hahnemannian Monthly*. He says: "Disease is a force (?) generated by matter, and must be conquered by matter."

Pretty good for the *Hahnemannian*. A splendid theory if only supported by facts. How easy it would be to practice medicine if this were only the case. We would only have to expel the matter developing the force (?), and presto! change! the disease is gone.

A man who advocates such a theory as this, evidently has never heard of disease being caused by grief, anger, fright, fear, anxiety; or from the *reel* of the passions, as Richardson so well expresses it; nor can he have known diseases to have been successfully treated by heat, cold, mental impression, rest, motion, *electricity*, etc.

Such a dogma is certainly not Hahnemannian, and it rather surprises us, coming as it does from such a journal. However, no one will dispute its originality; but, if the *Hahnemannian* means to father this dogma, would it not do well to change its name?

New Books and Instruments.

SEXUAL NEUROSES. By J. T. KENT, A.M., M.D, St. Louis. Sold by Dr. George C. Pitzer.

The author of this work evidently has had considerable experience in the subject upon which he writes, and handles it with a degree of familiarity, but at the same time in a style that is coarse, vulgar, and at times actually obscene. His therapeutics are moreover crude and meaningless, especially so as regards his uses of electricity. On the whole we do not consider the work a valuable addition to a physician's library.

SCRATCHES OF A SURGEON. By WM. TOD HELMUTH, M.D. Published by Wm. A. Chatterton, Chicago. Pp. 120, 12mo.

This is NOT a treatise on superficial lacerated wounds, as some might suppose, coming as it does from the pen of a surgeon, nor are the scratches mentioned those used by a patient afflicted with "scabies" to palliate the cuticular titillation.

The scratches are poems; and though these poems remind us occasionally of the scalpel, there is nothing of the SCISSORS about them. They are all original, brimful of satire, wit, or pathos, and show evidence of genius, taste, and learning. The work will, no doubt, have a large circulation.

POCKET THERAPEUTICS AND DOSE-BOOK. By MORSE STEWART, JR., B.A., M.D. Second edition, revised and enlarged. George D. Stewart, Detroit, Michigan.

A very handy little pocket remembrancer, giving a list of the principal poisons and their antidotes, the therapeutic uses of the most commonly used remedies, and a number of practical hints. The book is well arranged, and is made up in a convenient form for ready reference.

HOMŒOPATHIC THERAPEUTICS. By S. LILIENTHAL, M.D., etc.

The author of this work, in a brief and unpretending preface, introduces to the profession this second enlarged and revised edition, but modestly asserts no claim to merit or consideration for the service performed.

A cursory examination of its pages must convince the reader that its preparation must have consumed many hours in patient research and comparison, in order to accurately determine the special sphere

of each remedy in its application to the various forms of disease, and it is a marvel that Dr. Lilienthal, with his manifold duties, could have found sufficient leisure for the satisfactory performance of so arduous a task. The inference follows that he is invested with the attribute of ubiquity, and is a veritable *helluo librorum*, such as Cicero describes.

This volume should find a place upon the office table of every homœopathic physician, since it is a complete *repertoire*, and valuable for daily reference. It is in accord with the law of similitude, and gives precise directions for the therapeutic use of nearly every remedy embraced in our Materia Medica.

It is, however, obnoxious to adverse criticism in the introduction of several drugs that have never been subjected to a formal proving, and therefore have no therapeutic status, and are not entitled to recognition. Still this minor defect is more than atoned for by the numerous excellencies that enrich its pages and add to the knowledge of the practitioner.—J. K. L.

HANDBOOK OF PRACTICAL MIDWIFERY. Including Full Instructions for the Homœopathic Treatment of the Disorders of Pregnancy, and the Accidents and Diseases Incident to Labor and the Puerperal State. By J. H. MARSDEN, A.M., M.D. York Sulphur Springs, Pa., January, 1879. Boericke & Tafel. Pp. 310.

This is one of the very best books for the student and young practitioner extant. It is clear, concise, and practical. Unimportant details and rare conditions are omitted. Theory is subordinate to ractice. The matter is very readable, while at the same time very correct and fully up to the present state of obstetrics. This is especially notable with regard to the author's treatment of puerperal toxæmia. The benefits of chloroform are fully shown, and specific directions for its use inculcated.

The dangers and bad results of long labors and the frequent necessity for the use of the forceps are fully appreciated. The use of the long forceps is strongly advised. Hodge's form being given the preference, an unfortunate objection is made against the heavier styles of instruments. We think this departs from that strength in which alone is safety in many cases. Too decided a preference seems to be given to the French lock, which is erroneously stated to be the only one in extensive use in this country.

In speaking of the signs of pregnancy no mention is made of the change of color in the mucous membrane of vulva, vagina, and cervix, while there is a lack of stress upon the almost characteristic softening of these tissues. The presence of milk in the breasts in primipara is omitted as well as all mention of the uterine bruit. The

value of bimanual palpation in detecting an enlargement of the uterus in the early months is not spoken of. We think that the tampon should have been advised in cases of threatening abortion with hæmorrhage, while in speaking of it under the head of placenta previa more minute directions seem desirable. It is one of those operations where Sims's speculum is invaluable. By its use, until near the outlet, a large quantity of cotton can be well packed in, effectually stopping hæmorrhage without causing much suffering. There is no need of a string around the wads.

The author recommends Ergot in uterine inertia early in labor. The practice in his hands seems to have resulted in no injurious results, probably because small doses (gtt. iv–vi, ext. fld.) are used, although increase of dose is advised if the desired effect is not forthcoming, but without naming any limit or stating the method (*tonic* contraction) of its action with its attendant risks. Here, we believe, lies the danger in any but experienced hands.

With the head well down upon the perinæum, Ergot may be perfectly safe; above that point, the power for injury rapidly increases. It may produce extensive laceration of the cervix, vesico-vaginal or recto-vaginal fistulæ, rupture of the uterus, and last, but not least, death of the child. If the labor is rapid, rupture of the perinæum. The forceps, we believe, are far safer to both mother and child.

In condemning the usual distinctions between natural and preternatural labors, the author omits to state the signs of dystocia. These are gravely important. Every student should know how to tell when a labor is becoming too exhausting, when help is necessary. There is also no division of labor into the three natural stages. The author's objection to the dorsal position in labor as immodest, seems to those of us who always use it rather fastidious, while the greater ease of examination with the woman on the side which he urges has, we are sure, no basis in fact. The finger indeed bends toward the sacrum and its concavity, and not towards the uterus and pelvic brim, as with the examination in the dorsal position, where it follows the natural curve (or axis) of the pelvis. The position of the fontanels relative to the median line are with much greater difficulty made out, a fact very patent to those who frequently make gynæcological examinations in both positions with regard to uterine deviations. This method of examination may have led the author, in speaking of the diagnosis of the different presentations, to omit mention of the fontanels and their relative position, as well as external manipulation of the fetal trunk and the position of the fetal heart to the right or left of the umbilicus. Little weight is given to Bright's disease as a frequent predisposing cause of eclampsia, or to albuminuria as an unfavorable prognostic.

With these few exceptions, and some unimportant inelegancies of expression, the work, as a whole, is well written. Its size is convenient, the print is large and clear, and the paper and binding excellent.—W. Y. C.

A GUIDE TO HOMŒOPATHIC PRACTICE. Designed for the Use of Families and Private Individuals. By I. D. JOHNSON, M.D. May, 1879. Boericke & Tafel, Philadelphia, Pa.

This book is, without doubt, the best written work on Domestic Medicine that we have yet received from the press. It is not too large. It is easy of reference, and particularly clear and specific in its indications for remedies, while it embraces all the affections that may be intrusted to the layman. A Materia Medica of the fifty-six different remedies mentioned in the work is given, a feature of great value to medical students and the more intelligent class of patients. The prominent and characteristic symptoms are starred or placed in italics, both here and in the body of the work. The table of contents is admirably clear, with the one exception that the contagious diseases are not grouped together.

The synonyms, both common and technical, are in general correct and distinctive. We note but few exceptions, such as seminal emissions with masturbation, and stone in the bladder with nephralgia.

Pelvic peritonitis finds no place. Its symptoms, as well as those of simple ovarian congestion, are found under the head of ovaritis. Childbed fever is described as puerperal peritonitis, while typhoid and typhus are considered as one, and bilious fever is said sometimes to run into typhoid. Pneumonia of the aged is described under bronchitis.

The indications presented by the pulse, respiration, tongue, etc., are clearly and concisely given. No mention is made, however, of irregularity of the pulse as a sign of exhaustion, nor of ammoniacal urine with sediment as indicative of severe cystitis. In fact, healthy urine is said to be ammoniacal, and sediments are considered as due to hepatic disease.

In giving the symptoms of Bright's disease no mention is made of its clear pallor and marked weakness, nor of the frequent nausea and vomiting.

Incision in deep panaritium is not recommended, nor warning given of the danger of necrosis if not performed at the right moment. In speaking of impending death from anæsthetics, eversion of the tongue is not noticed; the cumbrous and dangerous battery is mentioned instead.

The author makes a grave mistake in recommending that insane patients be kept at home, both because we now possess most excellent

asylums, and for the reason that in a majority of cases the surroundings among which a person lapses into insanity are not the proper ones for his cure, and in fact tend otherwise.

With regard to the general ideas of homœopathic medicine conveyed, we object strongly to the book. We note the second paragraph of the preface:

"We have described the various diseases with sufficient minuteness and detail to enable any one of ordinary abilities to distinguish the complaint. We have pointed out the immediate and remote causes of the different maladies, and laid down the treatment so *clearly* and so *plainly* that no one need make a mistake."

This, coupled with the fact that in speaking of dangerous acute affections, the early presence of a physician is not advised, renders the book, we believe, a dangerous one,—dangerous alike to patients, physicians, and the reputation of homœopathic medicine, which requires such great skill for its uniform success in remediable cases.

The book is perhaps better adapted for the use of students in learning and applying the therapeutics of the common affections and the common remedies than to the layman as a domestic guide.—W. Y. C.

THE HOMŒOPATHIC PHYSICIAN'S VISITING LIST AND POCKET REPERTORY. By ROBERT FAULKNER, M.D. Second edition. Boericke & Tafel, New York and Philadelphia.

The present book is quite a model. Of a convenient size, printed neatly on excellent paper, it is intended for easy yet efficient use. The contents include an obstetric calendar, Hall's method of resuscitation for the drowning, table of the pulse, poisons and their antidotes, and an excellent repertory covering ninety pages, or about one-third of the book. Its only fault is the mention of too many remedies under each head. The body of the work is composed of alternate pages of daily engagements, under which space is given for the date, name, and day of the week; and of prescription records, under which a column is left for each day of the week. Removable memorandum pages and a pocket are appended at the end.—W. Y. C.

ANOTHER NEW MEDICAL JOURNAL.

We have just received the first number of the *Chicago Medical Gazette*, a semi-monthly publication, edited and published by E. C. Dudley, M.D. If the succeeding numbers are as good as the sample we predict a large circulation for it.

GAIFFE'S NEW MEDICAL GALVANOMETER.

We have received from M. A. Gaiffe, of Paris, a circular contain-

ing a description of a new galvanometer, the deflections of which represent in actual values the amount of current passing in British Association units. This is just the instrument we want in electro-therapy, as it avoids the tedious calculations of the tangent galvanometer. We have not yet seen the instrument, but hope to be able to give a detailed description in our next issue.

WE beg to acknowledge the receipt of a new "Universal" bath, the workmanship of Mr. E. J. Knowlton, of Ann Arbor, Michigan. We find this bath exceedingly useful in giving electrical treatment in cases where it is desirable to affect the whole spinal cord, and where immersion of the body is not contraindicated. The bath is made of sheet rubber (a perfect non-conductor), suspended from a light wooden frame, sufficiently long to allow an adult to lie at full length. It has a very simple arrangement by which the water in which the feet are immersed, can be separated from that covering the body and upper extremities, so that by placing one pole of a battery in the water covering the feet, and the other in the upper division of the bath, the whole spinal cord is at once influenced, a matter very desirable in some cases. The addition of a little carbonate of soda will make the water a good conductor, and it will also diminish the resistance of the skin. These baths are specially convenient where patients have to treat themselves, for with a few specific directions a person with ordinary intelligence can manage one sufficiently well to carry out a prescribed treatment. Besides its use as an electrode the bath can be used as a full immersion bath, sitz-bath; and by a contrivance similar to the one mentioned can be altered in size for a child's bath. The whole apparatus is very simple, and when folded occupies but little space. Is quite portable, only weighing fifteen pounds.

BOOKS AND PAMPHLETS RECEIVED.

Electricity in Medicine, and its Mode of Application. By John Ives, M.D. Published by John T. Ives, Jr., 288 Fourth Avenue, New York.

The Physician and Surgeon.
Scientific American.
Medical Counsellor.
Archives of Medicine.
Hahnemannian Monthly.
Druggists' Circular.
North American Journal of Homœopathy.
Medical Tribune.
Chicago Medical Times.

Hospital Gazette.
St. Louis Clinical Review.
The Homœopathic News.
Southern Medical Record.
The St. Louis Clinical Record.
The Michigan Medical News.
Revue Homœopathique.
The Buffalo Medical and Surgical Journal.
The Southern Clinic.
The Obstetric Gazette.
The Homœopathic Times.
The New York Eclectic Medical and Surgical Journal.
The Eclectic Medical Journal.
The Homœopathic Journal of Obstetrics.
The Ohio Medical Recorder.
The Organon.
The Maryland Medical Journal.
Transactions of the Homœopathic Medical Society of Pennsylvania.

Any subscriber not receiving his copy of the JOURNAL within a week after issue is requested to notify the publishers. Exchanges will please adopt the same course.

Sparks and Flashes.

JUST AWAKING.—The recognition of the organismal value of Phosphorus has led a large number of physicians to employ the metalloid. This theoretical conclusion, however, is very erroneous and easy to refute; Phosphorus cannot be taken in doses sufficiently large to supply any deficiency. If taken in doses of one-twentieth of a grain a day it nauseates the stomach, produces jaundice and tenderness of the liver, and if continued long it produces its poisonous phenomena. In 1870 Dr. George Wegner, of Berlin, Prussia, showed that Phosphorus, when administered in doses as small as one-sixty-sixth of a grain, produced fatty degeneration of the liver, kidneys, stomach, and heart; that in many cases it produced albuminous urine; that numerous hæmorrhages occur from all parts of the body owing to extension of fatty degeneration. The experience of Dr. Wegner, and a case which once came under my own observation, led me to investigate the toxicology of Phosphorus. I have tried Phosphorus

poisoning on rats, squirrels, and rabbits, confirming the results obtained by him. I have also encountered three cases of Bright's disease, which I am sure were produced by excessive use of Phosphorus. On the other hand, I have used Phosphorus in doses of one-one-hundredth of a grain thrice daily, and have found it really valuable as a remedial agent in this disease.—*Michigan Medical News.*

THE following notice appeared in a recent number of the St. Louis *Clinical Record:* "A New Medical Directory of the United States is preparing (sic) by Dr. E. J. Bermingham, 13 Lafayette Place, New York city." We knew that Dr. Bermingham was preparing such a directory, but we had no idea that the directory was preparing anything. It must be quite an active work.

WHAT NEXT ?—The *Scientific American* states that a man named Fancher, of Paris, has invented an electrical machine for stopping runaway horses. The poles are placed one in the mouth and the other under the tail of the suspected animal. A magneto-electric machine is situated in the driver's seat, with a handle for rotating the magnets within convenient reach. The instant the horse commences any pranks the Jehu electrician turns the handle and says whoa ! and the horse stops ; so it says.

Miscellaneous Items.

DR. J. J. CALDWELL, of Baltimore, in the *Southern Clinic*, calls attention to the use of the galvanic current, passed between the forehead and plantar surfaces, in the treatment of hydrophobia as advocated by Hammond. The feeble current should be persevered in for days, with chloroform and chloral during paroxysms, and nourishment administered hypodermically and by the rectum.—*Chicago Medical Gazette.*

THE TEMPERATURE OF CARBONS GIVING THE ELECTRIC LIGHT.—The temperature of carbons giving the electric light has been examined by M. Rossetti by means of a thermopile, the face of which is placed at a suitable distance to receive rays from a radiating surface of determinate size ; the thermal effect being measured by a sensitive reflecting galvanometer. He comes to the conclusions that : 1. The positive pole has higher temperature than the negative. 2. The temperatures vary according to the intensity of the current. 3. They are higher the smaller the radiating surface, provided it comprises the extreme point. 4. In the negative pole the minimum temperature was 1910° Cent., with a large radiating surface of small brilliancy ; the maximum, 2532° Cent., the radiating surface being

half the preceding. 5. For the positive pole the minimum temperature was 2312°, the carbon being large; the maximum, 3200°, with a thin carbon and small radiating surface.—*Scientific American Supplement.*

Sanitary Conventions in Michigan.—At a recent meeting of the Michigan Board of Health arrangements were made for the holding of two sanitary conventions in that State the coming winter. The first is set down for the second week in January, and will be held at Detroit; the second, at Grand Rapids, will be held in February. The subjects for discussion at Detroit will be: "Abattoirs for Cities;" "School Hygiene;" "Ventilation of Living and Sleeping Rooms;" "Cooking Schools;" "Plumbing for Dwellings;" "Prevention and Limitation of Contagious Diseases;" "Inspection of Food;" "Water Supply for the Family." At Grand Rapids the subjects will be: "Public Interest in and Importance of General Sanitation;" "School Architecture in Respect to its Hygienic Aspects and Importance;" "Sewerage, its Importance, its Benefits, and its Dangers;" "Sanitation of the Sick-room;" "Infection, the Everyday Dangers of it, and how to Prevent it." Accompanying these conventions will be a free exhibition of sanitary appliances, which manufacturers are invited to send. Articles of exhibit will be received by the Secretary of the Convention at Detroit, by Dr. C. H. Leonard, 50 Lafayette Avenue, from December 15th, 1879, to January 6th, 1880. The time for entering articles at Grand Rapids has not yet been determined. The judges will be invited to examine the articles exhibited, and certificates of merit will be awarded.—*Scientific American.*

Air as a Stimulant.—The exciting and stimulating properties of pure oxygen are well known, and every one has felt the invigorating influence of fresh air, yet no practical application has been made of these beneficial properties of a substance so cheap and universal. When the body is weak, the brain fatigued, and the whole system in a state of lassitude, just go into the open air, take a few vigorous inspirations and expirations, and the effect will be instantly perceived. The individual trying the experiment will feel invigorated and stimulated, the blood will course with freshness, the lungs will work with increased activity, the whole frame will feel revivified, and nature's stimulant will be found the best.—*Scientific American.*

The effects reported by Mr. J. Glax, of faradization of the abdominal muscles in promoting the absorption of ascites and increasing the excretion of urine seem almost marvellous. In the five observations made, under this simple treatment, the quantity of urine increased in two to three days, or rather in the same day from 200 to 3000 grams, from 70 to 800 grams, from 2000 to 24,000 grams

respectively. The method consists in making all the muscles of the abdomen contract under the influence of feeble faradic currents. The sittings last from forty to fifty minutes.—*Gaz. Hebdom.*, October 3d; *Maryland Medical Journal*, December, 1879.

A NEW BATTERY.—The merits of the Leclanché battery, now so universally used where no great amount of energy is needed, are familiar to all. This form of battery, which, it will be remembered, is charged with peroxide of manganese and sal ammoniac, has the great disadvantage, however, that when once the manganese is used up the element becomes useless, as it cannot be charged a second time. There has been great need, then, of some apparatus like this, which could be easily charged like other batteries. According to a note recently presented to the Society for the Encouragement of National Industry, by M. Marcel, an improved battery of this nature has lately been devised by M. Gaiffe. The new element is arranged thus: The binoxide of manganese is placed in deep holes drilled in a cylindrical piece of carbon, which forms the negative electrode, and which at the same time performs the function of a porous cup. The carbon is placed in a solution of chloride of zinc as an exciting liquid, and an amalgamated zinc rod forms the positive electrode. The solution of the chloride must contain from 15 to 20 per cent. of the zinc salt, and must be free from the presence of lead, and should be as neutral as possible. To insure a perfect contact between the carbon and manganese, the latter should be introduced little by little, and well shaken down before adding a further quantity. The manganese should also be of the needle form of variety, and in grains; the powdered kind is inferior. The electro-motive force of this new element is 1.5 volts, or the electro-motive force of a couple and a half of Daniell. Its constancy is relatively great, and it polarizes very slowly. This polarization disappears, moreover, almost completely when at rest, even when the battery has been hardly driven. In this battery, as in that of Leclanché, there is no waste of material when the circuit is closed, since the weak solution of zinc chloride has no action on either the manganese or the zinc. An interesting feature in the action of this element is that the oxide of zinc, instead of remaining attached to the zinc, falls in a state of powder to the bottom of the containing vessel, just in proportion as it is formed.

Although the inventor devised this battery for medical purposes, he has also made several forms applicable to various uses: one, 125 millimeters in height, designed for portable medical batteries; another, of 150 millimeters, for large medical batteries and electric annunciators; a third, of 185 millimeters, for telegraphic purposes; and, finally, one of 225 millimeters, for such applications as require the simultaneous action of several apparatus.—*Scientific American Supplement.*

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Original Articles.

ARTICLE XVI.

HOW TO PERFORM ELECTRO-SURGICAL OPERATIONS.

BY JOHN BUTLER, M.D.

(Continued from page 177.)

MALIGNANT GROWTHS.

THERE has been much diversity of opinion among electro-therapeutists relative to the actual value of electrolysis in malignant growths; as to how far the destruction of a cancerous tumor by electrolysis tends to diminish the liability of a recurrence of the disease. Some authorities assume that while it does not assure positive exemption from a return, it certainly lessens the tendency thereto. Others say that it offers no more immunity than does removal by the knife; and others, again, that it positively irritates the surrounding textures to such a degree that it increases the likelihood of a re-growth. Every man forms his opinion by the results of his experience; and while I have no fault to find with those who differ from me, I

wish to have the same privilege that I am willing to give others; that is, the privilege of stating the opinions that I have formed as the result of *my* experience.

I am firmly convinced that removal of a malignant growth by electrolysis *does* lessen the liability to a recurrence of the disease; that any case in which operative interference is necessary, electrolysis is the preferable method; that in certain cases where interference by the knife is not to be thought of, electrolysis is advisable. I have had many cases which substantiate these facts; cases which, having been previously operated upon by the knife, recurred in less than three months after the operation; but the secondary, and in some instances tertiary growths, having been removed by electrolysis, the patients recovered, and remained free from any tendency toward recurrence. Some of these operations are of several years' standing, and speak for themselves as to their value. They represent almost every variety of malignant disease: epithelioma, medullary sarcoma, spindle-celled sarcoma, etc.

That I have failed in preventing recurrence, it is true; but in each case of failure, either the whole of the diseased part could not be removed, or else the system was so impregnated with the disease, that the operation was undertaken with a view of prolonging the patient's life, rather than with a hope of the disease not reappearing.

I have no theory to offer as to how electricity acts in preventing a recurrence. It may be that it influences the surrounding parts by stimulating healthy nutrition—the secretion and formation of healthy cells, instead of the *mistaken* cells which form a cancerous growth; or it may be that after electrolysis, the absorbents are placed in such a condition that they are unable to take up and replant any of the few cancer-cells that may accidentally remain; or possibly it may be that the wound, after electrolysis, has to heal by granulation instead of by the first intention, and on that account there is not so much probability of the disease being regrafted, at the time of the operation. I am much inclined to hold the first theory, and for that reason, after the electrolytic slough has come away,

make repeated applications of the galvanic current (negative pole) to the healing ulcer. This course may be the secret of success; at any rate it very greatly hastens the process of cicatrization, and prevents contraction of the tissues taking place. In the case of very large growths, or where a large bloodvessel would be included if a slough were caused, or where from the position it is impossible to remove the whole of the diseased mass by electrolysis, I sometimes use Richardson's serrated scissors for its removal, and then thoroughly electrolyze the wound, leaving it quite open to heal by granulation; and during this process continue to make applications of the galvanic current as above mentioned. This treatment I have reason to be satisfied with in every respect.

Now as to the mode of procedure: should we decide to remove the growth by electrolysis, the first object to be attained is to so interfere with the blood-supply, as to cut off the nutrition of the diseased mass *in toto*, so that it will slough out. Anything short of this will not do; it will only irritate and do mischief. In order to attain this end, the best way is, to transfix the healthy tissue beneath the growth with several fine uninsulated needles; these must be parallel, and of such a length as to reach through the entire diameter of the part to be removed, and must be placed close together, the closer the better. These should form the terminal of the negative pole of the battery, the positive pole being terminated by one or two thick platinum needles thrust into the body of the growth. The current is now gradually allowed to flow, until the maximum intended to be used, is introduced, and at this strength it is continued, until the effect required is completed. The first noticeable effect is the bubbling of a frothy viscid material through the needle openings, alongside the needles (the mixed gases liberated through the electrolysis of the water of the tissues bubbling through the partially coagulated albumen). After a few moments it will be seen that a whitish-gray eschar has formed around each negative needle. This is most readily observed when the skin is intact. These separate eschars grow larger and larger in diameter as the operation progresses, until finally they

coalesce. When this result takes place, we may conclude that the part has been sufficiently acted upon, and that the blood-supply has been entirely cut off. We may now carefully withdraw our needles. The negative ones will be found to have become quite loose, and will almost fall out of themselves. The positive, on the contrary, are more difficult of removal, and firmly adhere to the textures in which they are imbedded. After removal, the openings made by the positive needles are much more inclined to bleed, than those made by the negative. The hæmorrhage, however, seldom amounts to much, and may usually be controlled by pressure on the bleeding points applied for a few moments with the finger. The chemical decomposition which occurs during electrolysis most of my readers are no doubt familiar with, being minutely described in all the textbooks on the subject; we will therefore omit any consideration of this here.

A tumor after electrolysis becomes considerably distended with the gases formed, which have no means of escape. A tumor formed of tissues which are not dense will sometimes become reasonant to percussion. This distension subsides in a very short time, and the mass assumes a shrivelled appearance. The contiguous parts become somewhat inflamed, the patient's temperature rises one or two degrees, sometimes even more, especially when large growths have been operated upon. The pulse rises sometimes as high as 120, and within twenty-four to forty-eight hours falls to about 100. After the third day a distinct line of demarcation appears between the eschar and the healthy tissues, and in from eight to ten days the slough comes away, leaving a healthy granulating surface underneath. This ulcer now needs frequent mild applications of the galvanic current, with broad metallic or carbon electrodes, of sufficient size and of such a shape, as will cover the whole of the denuded surface. This is, so far, the progress of the average case. Occasionally, however, I have seen the temperature rise to 105°, and the fever continue high for several days, in spite of the indicated remedies being thoroughly exhibited. Occasionally, too, I have seen the eschar become putrid, and require the use of

antiseptics. As a precautionary measure, I am in the habit of snipping away as much of the eschar as possible about the third day, and dressing the part with a weak solution of zinc chloride, though I have never known the slightest symptom of septicæmia to follow electrolysis.

As regards the definite amount of current to be used, there can obviously be no rule laid down, as that depends upon the size, density, and conductivity of the diseased tissue, and bears an inverse proportion to the length of time to be consumed in the operation. I am in favor of a moderate current, continued for a sufficiently long time, having reason to believe that such operations give better results than those in which very violent chemical action takes place. All such operations, of course, must be performed under an anæsthetic.

Cases of cancer, which although hopelessly incurable, may be palliated, and the pain much allayed, by the exhibition of electricity in another way.

One or two very fine needles (long harelip pins will answer the purpose very well) should be inserted into opposite sides of the tumor, penetrating well towards the centre of the growth; these may be painlessly inserted by the use of rhigolene or ether spray, as a local anæsthetic, or in many cases even without local anæsthesia being necessary. A very mild current should be allowed to flow through the tumor, the needles being the electrodes. One or two Daniell's cells or their equivalent will furnish amply sufficient electromotive force for any case. After the current flows a few moments, it is by no means unusual to find that the pain has entirely subsided, and that the weary worn-out patient has actually fallen asleep with the needles sticking in the growth.

It is only the first application patients dread. After one has experienced the soothing effect of the galvanic current used in this way, he will beg for its repetition and anxiously look forward to the time for the next application. As regards the duration of each seance, we must be guided wholly by the sensation of the patient. As soon as the pain subsides, the current may be discontinued. This result usually takes place in from

five minutes to half an hour, and the beneficial effects last from a few hours to several days. It needs hardly be said, that as long as the patient remains free from pain the application should not be repeated, but each return of pain may combated by a repuncture. Each successive puncture should be made at a new point, for if made every time at the same point, we soon have an eschar formed, and fistulous openings corresponding to the tracks of the needles made in the growth, which only add to the suffering, instead of diminishing it.

Once in a while we see more than a mere transitory benefit from this treatment; after a few applications the diseased tissue assumes a shrunken appearance, and the patient's health improves in a marked manner. I have not seen much benefit arise from the external application of moistened electrodes, but where the surface is ulcerated, much good may be done by using flat metallic electrodes applied to the ulcerated surface, instead of making punctures with needles.

In all cases the galvanic current is the form to use, as no possible good can come from faradizing the part, as many are in the habit of doing.

Fibroid Tumors.

Of course it is quite possible to destroy any benign growth by the treatment just described, but such a course is never necessary. Fibrous tumors may be treated electrically by one of two methods, at the discretion of the surgeon.

1st. By forming an eschar within the growth of a sufficient size to act as a foreign body; this excites suppuration, the tumor becomes an abscess, and the pus is evacuated, etc.

2d. By producing several small coagula within the growth, not sufficiently large, however, to cause suppuration; but large enough to lessen nutrition and hinder the blood-supply. Repeated operations of this kind will cause a tumor to become absorbed. There is no doubt that fibrous tumors have been dispersed by simply passing a galvanic current through them without puncture; this method is, however, uncertain and unsatisfactory, and under any circumstances needs long-

continued and tedious treatment, and very frequent seances. If, in a given case, we decide to employ the first-mentioned method we introduce several needles insulated to within about half an inch or an inch of their points (according to the size of the growth) into the body of the tumor, as near to the centre of the growth as possible. The needles should be close together, but great care should be taken that they do not touch each other. One or two of these needles should be connected with the positive pole, and the remainder with the negative. Enough of current should be allowed to flow to produce an eschar of the size we desire in a given time. This must be carefully calculated, for if we use too much current, or protract the seance, we slough out the whole growth and perhaps some of the adjacent tissues. If too little, the object is not attained. An anæsthetic is not always necessary, but the part should be sprayed while the needles are being introduced, in cases where an anæsthetic is not used.

In instances where the second method is the chosen one, as it generally is, we should proceed as follows: Insert several insulated needles within the growth, as far apart as possible, but as nearly equidistant as practicable; the insulation should penetrate well within the skin or mucous membrane, but it is of course essential (considering the objects in view) that the needles should have long uninsulated points. One of the needles may now be made the positive terminal, and the others the negative; or each alternate needle may be attached to one pole, and the remainder to the other, at the option of the operator. The needles attached to the positive pole should be made of platinum, otherwise there is much difficulty in removing them; besides, secondary electrolytic action takes place, which tends to suppurative action around the tracks of the needles, which, of course, should be avoided. We only require a mild current, regulated in strength according to the work to be done, that is, to the size and number of the coagula we wish to produce, and as that altogether depends upon the size of the tumor, it is obvious that no explicit directions on this point can be given, as it is impossible to average such matters.

This operation has to be repeated again and again at intervals, until the desired result is attained. There is never much inflammatory action after a properly performed operation, but always some; and I make a practice of always waiting at least a week after the inflammatory symptoms of one operation have subsided before making a second. This method is applicable to fibroid growths in any part of the body. I have successfully treated many uterine fibroids, both submucous and subperitoneal, by its use, as well as fibroid goitres and tumors elsewhere attached.

Fatty Tumors.

Although it is quite possible to destroy these tumors by electrolysis, it is not by any means to be recommended as the best mode of treatment; for fatty tissue, conducting electricity only through the medium of the small amount of water it contains, is a very poor conductor, and can, therefore, scarcely be called an electrolyte. It follows from these facts the tension of current requisite to produce even a very small eschar must be very great, and the length of time consumed in an operation proportionally great. These facts in themselves would not be serious objections did removal of such growths by electrolysis possess any manifest advantages over excision; but as enucleation by the knife is a very simple operation, by which the whole of the adventitious mass can be at once removed and the tissues covering the growth immediately brought together, which unite generally by the first intention, so I venture to doubt that any instance ever occurs where it is at all desirable to remove these growths by electrolysis.

Adenoid Tumors.

Electrical treatment of these tumors may be undertaken with one of three objects in view:

1st. To promote absorption and stimulate the normal nutrition of the part.

2d. To produce small eschars within the growth, which shall

act as barriers to the free blood-supply, and so cause a diminution in size, and finally absorption.

Or, 3d. To cause it to terminate in an abscess in the manner previously described under the heading of "Fibroid Tumors."

The details of the treatment require to be essentially modified according to the end we wish to accomplish.

When we desire merely to stimulate absorption, and use the catalytic effects of the current, we simply apply a moistened electrode (negative) on the tumor, the electrode being of such a shape and size as to cover the entire growth, and the other electrode upon the skin adjoining. This latter should be constantly moved in a direction around the growth during the seance, and not allowed to remain long on one part. Daily seances give the best results.

The secondary induced current has made several cures, and is preferred to the galvanic by many authorities.

If this treatment succeeded in all cases, it would of course be the most preferable mode of operating; but very often it will not. It then is a question to be decided by the surgeon, whether in a given case it is best to make several small eschars within the tumor, and repeat the operation several times, until the end is accomplished, or make one large eschar which will cause the growth to suppurate. The mode of operating with either object in view, is essentially the same as that described in speaking of the treatment of fibroid tumors; but adenoid tumors yield to the action of the current much more readily than do fibroids, therefore we do not need to use so much current in an operation on the former; and we should take great care when operating with the result of the second mode of procedure as our aim, lest we cause the whole growth to slough out, by using too strong a current, or unduly continuing its action.

Cystic Tumors.

In the October number of this journal I alluded to the treatment of cysts with serous contents and their successful treatment by electro-puncture. We will now, therefore, only consider those with pultaceous or semi-solid contents.

These are difficult growths to electrolyze. I mean to so electrolyze as to destroy the sac and contents without at the same time destroying the skin covering the tumor. Electrolysis of the contents of the sac will not do. If the sac is not also destroyed, it will refill, and so cause a reappearance of the tumor, and if the sac is a thick one, as it so often is; by using a more powerful current than is requisite we cause an eschar of the surrounding, and superjacent tissues. I do not know of any rule by which to hit the happy medium, except that taught by long experience. Nor do I know that electro-puncture has any advantage over excision, except that it is not so much dreaded by a nervous patient.

Ulcers.

So far we have only discussed the destructive action of the current. We now have to consider it from another point of view. It is well known that electricity has the power of evoking function, of stimulating functional activity, of promoting healthy nutrition. With these objects in view, it is often made use of in the practice of medicine. In surgery, in the treatment of indolent ulcers, these effects are apparent. Under the influence of the galvanic current, old-standing indolent ulcers, that have resisted almost all kinds of treatment, seem immediately to take on healthy action, granulations spring up, and cicatrization advances in a manner little short of magical. Now as to the mode of using the current. There are numerous methods described in the various textbooks, all of which are of more or less value. There is one, however, that has not been described, and one which I prefer to all others; it is carried out as follows: I apply a piece of rather thick tinfoil to the ulcer, which it should accurately fit. Another piece of foil covered with moistened lint is applied to an adjacent surface; the first piece of foil is now made the negative pole of a small chloride of silver cell, and the other piece of foil the positive terminal. The part should be bandaged so as to retain the pieces of foil in their places, and then the current allowed to flow. The application may be con-

tinued for hours or days, as the indications require. A plumbago rheostat included in the circuit answers admirably to regulate the flow of the current. The sensation of the patient is here the safety-valve and galvanometer. The current should not be perceptible to sensation, but should be kept just below the point at which burning is felt. If there be the slightest burning sensation there is too much current flowing and destruction of tissue going on. The rheostat regulates this to a nicety, and after a little instruction the treatment, to a great extent, may be safely left in the hands of an intelligent nurse, or of the patient himself.

ARTICLE XVII.

POSTERIOR SPINAL SCLEROSIS.

A THESIS FOR ASSOCIATE FELLOWSHIP OF THE NEW YORK MEDICO-CHIRURGICAL SOCIETY.

BY EDGAR V. MOFFATT, B.S., M.D.

(Continued from page 207.)

CUTANEOUS sensibility intact in cerebellar disease; much impaired in posterior spinal sclerosis.

In affections of the *peduncles of the cerebellum* there is an irresistible desire to move sideways.

The history will aid greatly in the diagnosis.

In *progressive muscular atrophy* muscular power is lost, co-ordination retained. Jerking, twitching, and tremor of the muscles well marked. The anterior roots are affected. Tactile sensibility is unimpaired; and the *electro-muscular contractility is much diminished.*

The ophthalmoscope will often determine the diagnosis in simulating cerebral and ocular troubles.

Multiple sclerosis, when affecting the posterior columns, may simulate locomotor ataxia very closely, and, in fact, it does produce ataxia; but cerebro-spinal sclerosis shows a much

wider range, including great vertigo, psychical disturbances, headache, early nystagmus, scanning speech (different from the ataxia), the characteristic tremor on voluntary motion, paralysis, *increased* reflex action of the tendons, and the apoplectic attacks.

Progressive cerebral paralysis may be distinguished by its characteristic disturbance of speech and psychical changes.

Ataxia may sometimes simulate *paralysis of the lower extremities;* tests, such as resistance to passive motion, show the muscular power to be vigorous in the former, and lost in the later.

In *chorea* the jerking occurs independently of voluntary effort, and is of very different character from that of ataxia. The history will probably distinguish between them.

PROGNOSIS.—The prognosis of posterior spinal sclerosis, though still dark, is brightening year by year, as the resources of homœopathy are more fully developed and directed to its cure.

Our treatment already shows a gratifying degree of success when compared with that of the old school; but still the great majority of cases are incurable, even under the best of treatment. A physician does well who holds the disease in check for a time; but death awaits most of the victims after an average interval of about seven years, though they sometimes linger for thirty or more.

Long periods of non-development, and even of slight temporary improvement are common; but permanent recovery is rare.

Hammond cured *five* out of *ninety-two* patients.

Much, however, can be done to alleviate distressing symptoms, especially by homœopathy.

The prognosis is better from the absence of a predisposition or hereditary tendency; a previous moderate life as to sexual and other excesses; wealth and social standing, allowing rest, change of air, skilled treatment, etc.; and if the disease runs a long, slow course.

The reverse of these conditions will of course hold true.

THERAPEUTICS.—

Allopathic:
- Hydro-therapeutics.
- Electro "
- Drugs.
- Symptomatic indications.

Hygiene.
Homœopathic.

HYDRO-THERAPEUTICS.—First in the list of remedial agents may be mentioned *thermal-baths.*

Leyden alone of all the authorities I have consulted on therapeutics believes firmly in thermal-baths for posterior spinal sclerosis. All other authorities who mention them at all condemn them as *at least* useless, except where other treatment fails; then the indications are: great irritation, as lancinating pains, sleeplessness, etc. Here the general sedative effect of warm bathing is the point desired.

The baths must be 90° *F. or lower,* not longer than fifteen or twenty minutes, or oftener than two or three times a week.

Sulphur-baths are about equivalent to the ordinary thermal.

Certain saline thermal baths, as those of Rehm, Nanheim, etc., have enjoyed a fair reputation, but must be used with the above cautions.

Cold water treatment is thought by many authors to be quite beneficial (Leyden to the contrary notwithstanding), for, if properly used, it hardens the skin, promotes its free action, helps the general nutrition, and thus, secondarily, that of the spinal cord.

No acti veor exciting form of bath should be allowed, and but rarely a temperature below 68° F. Simple wet rubbings from 77°, cooling to 68°, or rarely to 59°, are very useful. Half baths or hip-baths from 86° to 70°. Sprinkling and rubbing the back during the hip-bath are also excellent methods of application. But sensitive anæmic patients do not bear this treatment well.

ELECTRO-THERAPEUTICS.—Authors vary as to methods of application; but weak, or at most only moderately strong cur-

rents, properly administered, are of acknowledged benefit. Usually the constant current (or, as Erb calls it, the "stabile"), and more rarely the induced or "labile," are used with short sessions.

Von Krafft Ebing advises the constant current through the spinal cord, with the negative pole (or "cathode") of the induced current over the nerve trunks.

Four to six minutes' sessions.

Erb recommends the positive pole (or "anode") in cases of irritation, in sensitive patients, in recent active morbid processes, etc., and the negative where there is a lack of irritability, slow chronic processes, with drying of the tissues, as *atrophy, sclerosis, etc.*

In all cases use large electrodes, say 2 x 4 inches. If they be too small, a current powerful enough to produce the desired effect would give intense pain, especially with the constant current.

If but a small portion of the cord be involved, one pole over the estimated seat of lesion, and the other on the sternum or abdomen, will pass a current directly through the cord.

The galvanic current is far better than the faradic, for its power of penetration is greater, that is, it will affect structures lying remote from the surface, and its "catalytic action" is more strongly marked.

It is claimed that by implicating the cervical sympathetic ganglia in the galvanic current the nutrition of the cord may be strongly influenced by acting on the trophic and vasomotor paths which pass through the ganglia.

This constitutes the indirect catalysis of Remak.

Erb approves of this method, and directs the negative pole of the galvanic current to be placed over the superior ganglion of one side, and the positive on the other side of, and close to, the spinous processes between the shoulders. The positive pole is to be slowly passed down to the conus terminale.

Repeat, changing sides. This may be followed by direct galvanizing of the cord, positive below and negative above, then slowly exchanging their positions.

Should this treatment not seem beneficial after a prolonged trial, and in many cases it does not, or if the patient wilts after each sitting, and the general condition seems worse,—*stop it.*

Sometimes no effect can be seen for many weeks; then improvement sets in and a brilliant recovery ensues.

For the gastric troubles Hammond recommends that, together with certain drugs, to be mentioned later, the pneumogastric be galvanized by placing the positive pole over the nerve in the neck, and the negative over the epigastrium. For the general condition galvanize the spine.

Drugs.—Many have been recommended but comparatively few chosen, and concerning those testimony is conflicting. The treatment is mainly empirical, very few indications being given.

Nitrate of silver stands high as having done good service, but no special indications for its use are given, except by Hammond, who prescribed it in *motor disturbances* when Ergot has failed, ¼ *gr.* 3 *times a day.*

Iodide of Potassium.—Considered efficatious by Leyden in soothing irritation and subduing meningitic complications, especially if syphilis be present, or if the sclerosis be of syphilitic origin.

Bromide of Potassium.—Recommended by Sireday to lessen pain and incoordination, in doses of 45 *grs. to* ʒijss. Hammond speaks well of it, but as he uses it together with large doses of Ergot and the galvanic current, nothing exact can be learned from that prescription. He gives 30 *grs. to* ʒj 3 *times a day.*

Ergot is recommended in the early stages by Waldmann, Althaus, and Hammond, especially in event of meningitic complication, 15 *to* 30 *grs. a day, long continued.*

Belladonna is given by Waldmann with Ergot for the same affection, and in the *same dose* as above. Hammond recommends it for paralysis of the vesical sphincter.

Arsenic and the *Chloride of gold and sodium* are well spoken of.

Chloride of barium is recommended by Hammond, $\frac{3}{4}$ *gr. 3 times a day.*

Chloride of ammonium it seems to me might be useful from its power to dissipate fibrous growths of certain kinds.

Strychnia Erb finds *hurtful.*

Phosphorus, recommended by Dugardin, Beaumetz, and Hammond, and condemned by Erb.

Cod-liver oil, useful through its general nutrient qualities, notably of nerve tissue.

These are the principal remedies for the disease in general. As there are many symptoms which may be alleviated, the following *symptomatic indications* may be found useful:

For the *lancinating pains,* after a long list of drugs, plasters, poultices, etc., Erb recommends hypodermic injections of Morphine as the best remedy.

Hammond uses Codeine for the pains about the back, abdomen, and chest in $\frac{1}{2}$ *to* 2 *gr. doses.* Althaus prescribes Salicylate of soda, 20 *grs. several times a day,* as the best palliative.

For the *painful hyperæsthetic points on the skin,* Erb uses faradization or else the negative pole of the galvanic current.

Cutaneous anæsthesia, motor weakness, and *muscular atrophy* call for electricity in appropriate forms and methods.

In *weakness of the bladder* faradize from the surface or by the bladder electrode.

Catarrh of the bladder and cystitis should be controlled by keeping the bladder clean, and neutralizing the alkalinity of the urine. Salicylic acid, 30 to 60 grains a day, are given in watery solution by the mouth, and a solution 1 : 500 injected into the bladder. It destroys the foul odor, clears up the urine, and renders it acid.

Here Althaus again uses the Salicylate of soda.

Benzoic acid is claimed by Gosselin and Robin to be superior to Salicylic; it renders the urine acid and reduces the catarrh. Dose 30 to 90 grains daily in emulsion or powder.

In *catarrhal inflammation* the ordinary astringents are useful,

as Uva ursi, Tannic and Gallic acids, Copaiba, Oil of turpentine, etc.

In *severe cystitis* wash out the bladder regularly and carefully with the lukewarm water, gradually making it colder. Weak solutions of Salt, of Tannin, of Nitrate of silver, Salicylic acid (1 : 500), etc., are found useful.

Bedsores.—PROPHYLACTIC TREATMENT may effect much. It consists in relieving prominent points, as the sacrum, trochanters, knees, heels, etc., from continued pressure by frequent change of position, by air and water cushions, millet bags, buckskin, quilted pads of required size and shape, etc.

Remove all filth (urine and fæces) from places where pressure is to be borne; preserve *perfect cleanliness*, and anoint with grease or oil.

Stimulate the vessels and tissues of the skin by washing with cold water or alcohol, and moderate faradization.

If light bedsores appear (superficial ulcerations furuncles, etc.) the above treatment continued, with mild irritant salves, Zinc ointment, Chamomile-water, or aromatic wine as external applications will be sufficient.

Gangrenous bedsores, extending rapidly, are far more serious. The first great indication is to remove the dead mass. To effect this, Brown-Sequard recommends the application of ice for ten minutes, then hot poultices for one or two hours. When the slough comes away use Carbolic acid as an antiseptic dressing.

An excellent device for curing bedsores, as well as sluggish ulcers, stumps, etc., is a simple voltaic pile, consisting of a plate of copper or silver placed on and fitted accurately to the sore, and another of zinc, under which is a cloth kept moistened with vinegar, on a more or less distant part of the skin, and the two connected by a wire. A current is generated which stimulates the vital processes and produces rapid improvement in the sore.

As sores are apt to appear under the zinc plate, it should be moved daily.

This battery is highly recommended by Helmuth, Hammond, Crussel, and Spencer Wells.

Hammond* reports cases in which bedsores, three or four inches in diameter and half an inch deep, were entirely *healed* by it in 48 hours; and Spencer Wells has often seen large ulcers covered with granulations in 24 hours, and completely filled up and cicatrization begin in 48.

Amaurosis is incurable. Strychnine is useless, and galvanism usually the same.

An arrest of further development is all that can be hoped for.

Constipation, usually very obstinate, calls for the mildest purgatives, as Huny à di Janos water, with a diet of fruit, graham, etc., and simple enemata.

Should this be ineffectual, regular faradization of the intestine, using a strong current, with one pole in the rectum and the other moved over the abdomen, may accomplish the desired result.

The gastric derangements require the constant current through the pneumogastric, as recommended above by Hammond.

He finds Boudalt's Pepsin, 15 to 20 grains with each meal, render admirable service.

In the intense *gastralgia,* Erb advises the hypodermic injection of Morphine and a strictly limited diet.

Increased sexual excitability and pollutions call for Bromide of potassium, 30 to 90 grains. Cool hip-baths and sleeping on the side with the bladder empty are useful precautions. Lupulin and Camphor have been recommended.

So much for medication and active treatment.

General hygienic measures, as judicious exercise, careful diet, sleep, warm flannels always next to the skin, plenty of fresh air, summers by the seashore or in the mountains, avoiding hurtful employments, etc., are very important, but will doubtless occur to every intelligent physician, and need not be de-

* Dis. of Nerv. Sys., p. 454.

tailed here. *A very valuable* precaution is to always use crutches, in order to save the weakened spine the extreme expenditure of nervous force required in ataxia walking.

HOMŒOPATHIC THERAPEUTICS.—It is almost impossible to give a complete and practically useful treatise on the homœopathic treatment, for every case must be an independent study in itself. Hence the most that can be done is to name the principal remedies and such leading symptoms of the disease as fall in their pathogeneses. If we had a more or less routine system of treatment for the disease and its various complications, like that of the old school, our task would be comparatively light.

But as it is we must be content with laying a broad foundation, and letting every man fill in the details for himself.

In the following pathogenesis it is taken for granted that the general characteristics of the drugs are familiar, so I only dwell on those especially seen in posterior spinal sclerosis.

In the early stages at least the remedies will often vary with the causes of the disease.

Heredity.—Psorinum? Syphilinum?

Syphilis.—Syphilinum, Mercurial preparations, Aurum, Nitric acid, Phytolacca, Hepar, Sassafras, Iodides, etc.

Sexual Excesses.—Phos., Phos. ac., Nux, Agar., Calc. carb., Staphisag., and *Picric acid.*

Cold Moist Atmosphere.—Ammon. mur., Borax, Calc. c., Carb. veg., Acon., Cepa, Dulc., Lach., Rhod., Rhus, Verat.

Overexertion and Fatigue.—Rhus arn., Dulc., Cocculus, Ars., and Sulph.

Depressing Emotions.—Ars., Arg. nit., Coloc., Graph., Hyos., Ign., Lach., Lyc., Nux, Phos. ac., Staph. and Verat.

Suppressed Footsweats.—Cupr., Nitr. ac., Cham., Merc., Natr. mur., Puls., Rhus, Sepia, *Silic.*

Idiopathic.—BELL., PLUMBUM, ETC. In the early stages, Acon., *Bell.*, Bry., Rhus, Ruta, Guaco (lesions, specially congestion and apoplexy of the *upper cord*), Phos., etc.

Remedies in General.—Æsc. h., Agar., *Alumina,* Angustura (spurea), *Arg. nit.,* Ars., Atropia, BELL., Caust., China,

Cocculus, Conium? Cinnis? Cupr., Curare? Cyclam., *Gels.*, Gratiola, Hell., Iodine (?), Lach., Nux mos., *Nux vom.*, Oxal. ac., *Phos.*, Phos. ac., Physostig., Picric ac., PLUMBUM (met. or acet.), Puls? Rhus t., Secale? *Silic.*, Stram., *Sulph.*, *Thallium*, Zinc, Sulph.

The following verifications (*) and underlining are mainly from Allen's *Enclycopedia:*

AGARICUS MUS.

Eye.—**Ptosis. Switching of the lid and ball. Ambloypia.* Diplopia. **He reads with difficulty, the type seems to move.*

Abdomen.—Much flatus (inodorous).

Urinary System.—Difficult micturition; retention. Incontinence when desire comes from paralysis of sphincter.

Sexual System.—*Frequent erections; great sexual desire; lively desire for an embrace, with relaxed penis.* Every embrace followed by nightsweats, great weariness and lassitude, which last several days; desire diminished; great aversion to coition.

Back.—**Pain in the back as after continued stooping.* *ACHING ALONG BACK AND LIMBS. Muscles of back feel bruised and on bending forward feel too short. **Formication* along spine. *SPINAL COLUMN SENSITIVE TO TOUCH. Violent electric-like shocks, emanating from the lumbar vertebræ, shooting through lower part of body.

Extremities.—They go to sleep easily. *SHE *feels as if her limbs did not belong to her.* Sensation of electric shocks and piercing pains in every limb. Formication in all extremities.

Upper Extremities.—*Irregular hurried movements of the upper limbs.*

Lower Extremities.—Formications in gluteal muscles, with cool creeping from legs to toes; coldness in the glutei; electric stitches in skin of anterior part of thigh; tearing pains through the limbs; great weakness and heaviness of the feet; crawling itching, burning coldness, or formication in feet.

Skin.—Stitching, biting, stinging, prickling, and formication all over.

Agaricus seems better indicated in spinal irritation and meningitis than in post-spinal sclerosis, yet the electric pains and certain forms of paræsthesia are well represented.

Alumina.

Alumina.—(Bœnninghausen states that the action of *Alumin. met.* is identical with that of *Alumina,* except that it is far more intense. (This fact seems to hold generally with metals and their oxides.) As provings of Alumin. met. are quite rare, I have compiled mainly from Alumina. Then if Bœnninghausen's assertion be true, by intensifying the symptoms you will have the indications for Alum. m., a remedy highly recommended in locomotor ataxia.)

Eyes.—*Amblyopia, strabismus,* yellow-tinted vision, *ptosis.

Abdomen.—Painter's colic; hypochondria pressed and screwed together; pinching colic pains.

Stool.—*Atony of intestines, so even soft stools are only passed by great pressing.* *RECTUM SEEMS PARALYZED. *SMALL HARD EVACUATIONS WITH PRESSURE AND SENSE OF EXCORIATION OF RECTUM.

Urinary System.—Frequent ineffectual desire to urinate; can do so only during stool. **Feeling of weakness in bladder and genitals.*

Sexual System.—Violent and frequent erections and emissions, at first intense desire, then decreasing and moderate instinct, finally total loss of sexual instinct.

Back.—**Gnawing pain in the sacrum, relieved by stretching. Lancinating in the small of the back in the evenings.* **Pain in the back, as from a hot iron thrust through the lumbar vertebræ.*

Extremities.—Fourth and fifth fingers (distribution of ulnar nerve), right knee, and then the heels go to sleep after sitting.

Upper Extremities.—*Lancinating bone-pains in upper arm and elbow.* Prickling from arm to shoulder; arm feels shorter. Intense itching in fingers and hands. *Pain in arm down to fingers, as if a hot iron were thrust through it.*

Lower Extremities.—Legs heavy, can scarcely lift them.

Violent lacerating all through limbs. **Pain in the sole on stepping, as if soft and swollen.* Numbness in foot and heel, worse on stepping. Stinging, itching, titillating, and prickling in soles, worse from warmth in walking. Shooting pain in ball of foot at night. Cutting in right great toe, as if stepped on a knife, in walking. Sense of burning sensation in back of hands and feet, as from swelling. Pains striking like lightning in right shoulder, back, and abdomen, followed by a bruised sensation. **Slow tottering gait as after a severe sickness.* Involuntary motions and jerkings of single limbs. Great exhaustion and trembling weakness. *Wants to lie down,* but is worse on lying.

Generalities.—*Various parts feel too large.* Most symptoms come on while sitting, decrease on walking. Sensation of constriction in internal organs (œsophagus, stomach, rectum, and bladder).

ARGENTUM NITRICUM.

Mental Confusion.—HEAD: Tendency to fall sideways. Vertigo on walking with the eyes closed, which alarms him. *Tremulous weakness and SENSATION AS IF HEAD WERE IN A VICE.

Abdomen.—*Violent cardialgia waking her in the night; twisting of the stomach, which extends down into the abdomen. Stitches like electric sparks dart through abdomen on left side on sudden transition from rest to motion.*

Stool.—GREEN DIARRHŒA. Violent constipation; *dry firm alvine evacuations.*

Sexual System.—*Absence of desire; shrivelled genitals.* Emissions. Impotence.

Back.—*Tensive squeezing pain in the back. Pains in the small of the back relieved by standing or walking. Nightly pains in the back.* Heaviness and drawing in the loins, with debility and weariness; trembling in the legs as after a fatiguing journey.

Extremities.—Numbness, *lassitude, and heaviness of all the limbs. *Paralysis of the extremities. Limbs feel as if they would go to sleep or become rigid.

Upper Extremities.—Violent boring pain in right shoulder; nightly bone-pain in ulna.

Lower Extremities.—He vacillates in walking. Staggers when walking in the dark, has to seize hold of things. **Paralytic weakness and heaviness of legs, so she does not know where to put them.*

Generalities.—*TREMULOUS WEAKNESS. **Sensation as if body, especially face and head, expanded and bones of head separate, with fever.*

ARSENICUM.

Sudden fine burning neuralgia; great weakness; anæsthesia of hands, feet, and fingers; feet and hands feel furred; soles don't feel floor, etc.; constriction at knees.

ATROPIN.

("Hughes in his *Therapeutics* mentions *Bell.* as the remedy of all others in the early stages of ataxia, including in its pathogenesis all those incongruous symptoms which characterize the idiopathic disease, as the dilated and sometimes varying pupil, strabismus, ptosis, etc. *Atropin* causes incontinence of urine and involuntary evacuations, and has produced anæsthesia of all the trunk and limbs. *Bell.* and *Atropin* both strongly depress reflex excitability. The lancinating pains are prominent, being sharp, sudden, lasting awhile, then subsiding abruptly and reappearing in another part. The motor derangement is characteristic under Bell., *true ataxia having been produced.*")

PATHOGENESIS.

Eye.—Protruding eye. Injected conjunctiva. Pupils immovable but not dilated, with amblyopia. Pupils much dilated, but react to light, objects look reddish (but no distinct color-blindness produced). Amaurosis. Diplopia, all objects seem elongated; diplopia, lateral; diplopia, perpendicular, *i. e.*, apparent object seen below the real one. Loss of power to estimate distance.

Speech.—Indistinct and stuttering.

Stomach.—Many symptoms of nausea and vomiting, °severe gastralgia, °spasmodic or neuralgic colic.

Stool.—Palalysis of sphincters of rectum and *bladder.

Urinary System.—Constant and frequent desire to urinate, but inability to do so. Incontinence with involuntary defecation. Urine passed slowly, and increased in quantity. Retention.

Extremities in General.—Weakness, heaviness, and numbness of limbs; cold extremities; trembling and jerking of limbs.

Upper Extremities.—Partial loss of sensation; cannot tell when I am holding small objects in the hand. Upon picking up a pin, felt as if he held five or six. Cannot tell when the hand touches an object. Muscles of the extremities jerk.

Lower Extremities.—Her legs felt like sticks; walked with difficulty; staggering, tottering gait.

Generalities.—Anæsthesia of the whole surface.

Motor Disturbances.—Able to walk a mile, then could not put key in door, his hand felt so stupid and shaky. Displays considerable strength, but his movements are unsteady, as if he had lost some control over his limbs. Was unable to feel his arms or legs.

BELLADONNA.

(Bell. produces congestion and consequent sclerosis of the posterior columns. (See Extremities and Generalities.) See introduction to *Atropin.*)

Eye.—*EYES PROTRUDE; *PUPILS DILATED; strabismus. **Injected conjunctiva;* *AMAUROSIS; AMBLYOPIA. **Contracted pupils.* **Diplopia;* **objects look double, upside down, or crooked.* *OBJECTS LOOK RED. °Ptosis.

Speech.—Stammering and impeded.

Stomach.—**At night periodical pains at epigastrium, with tremor.* **Burning in the stomach.* **Violent shooting-cutting pains in pit of stomach, forcing one to bend the body backward and hold the breath.* *Epigastrium tender.

Abdomen.—Violent stabs, as with a blunt knife, at different

parts of the abdomen. *VIOLENT CUTTING PRESSURE IN THE HYPOGASTRIUM, NOW HERE, NOW THERE.

Stool.—**Diarrhœa.* **Constipation.* **Involuntary defecation from paralysis of sphincter ani.*

Urinary System.—Bladder half paralyzed. **Very frequent desire to urinate.* Diuresis. **Scanty urine.* *RETENTION OF URINE, WHICH ONLY PASSES DROP BY DROP. *ENURESIS FROM PARALYSIS OF SPHINCTER.

Sexual System.—Weakness and relaxation of the genitals. Frequent involuntary erections and emissions. Loss of sexual desire; nocturnal emissions with relaxed penis. Feeble but abundant ejaculation.

Back.—*Lancinating from without inward* in the vertebræ, as from a knife-stab. Dull, intensely painful drawing in the whole circumference of the pelvis. Pain as from a sprain in right side of back and spine.

Extremities.—Trembling weakness and lassitude of the limbs. Tottering gait, with raising one leg, as if ascending a hill. **He slowly and with trembling lifts the extremities, then throws them down with greater force.*

Upper Extremities.—*Arms heavy, as if paralyzed.* Arms move as if choreic. Loss of co-ordinating power. In eating he often put his hand in the soup instead of the spoon; then could not find his mouth. Violent stabbing, as from blunt knife, below head of humerus. Sharp shooting up ulnar nerve, etc.

Lower Extremities.—He had very little control over or power in his legs. Inability to walk, not from weakness, but from lack of control over her limbs. *Paralysis of lower extremities, together with neck of bladder and sphincter ani.* *Stumbling, tottering gait. Paroxysmal neuralgic pains in hips, groins, thighs, and knees, worse in the afternoon and night, by contact and exercise. Cutting and shooting through legs. *Pain in the leg as if jammed, with dull tearing internally, worse at night, better by letting leg hang.* When walking raises foot high, as if stepping over a high obstacle. Numbness of feet and legs. Burning in soles, as if walking on fire.

Bruised pain in heel when walking on it. Boring, shooting, stinging, and digging pains in soles.

Generalities.—All her motions and actions were unsteady and uncertain. "In most of the cases the will-power over the muscles was so far disordered as to produce irregular staggering motions; great weakness." Complete anæsthesia of the whole body. Bell. pains are *boring*, shooting, worse from light touch, better from heavy pressure; shoot upwards; worse at night, in a thunderstorm, and from a change of weather (all prominent features of the "lancinating pains"); also they suddenly cease, and reappear at another point.

Skin. —Formication and itching over body, fugitive, now here, now there; biting and itching in feet.

China.

China.—Girdle pains at different localities. SENSATION IN THE LOWER LEG AS IF THE GARTERS WERE TIED TOO TIGHTLY, AND AS IF THE LEG WOULD GO TO SLEEP AND BECOME STIFF.

Conium.

Bad effects of suppressed sexual desire or excessive indulgence.

Gelsemium.

Eyes.—Strabismus. Eyes fixed with strabismus. *PTOSIS. **Diplopia on inclining head to shoulder.* Dilatation of pupils. Amblyopia, amaurosis, sometimes with great vertigo.

Stomach.—Gastralgia, with intoxicated sensation, *sudden spasmodic pain in upper abdomen so he cries out; it leaves a sensation of contraction.*

Urinary.—Paralysis of sphincter and *enuresis.*

Sexual.—Involuntary emissions without erections; sexual weakness from irritability of seminal vesicles. Genitals cold and relaxed.

Extremities.—"*I gradually lost control of my limbs so that I could not direct their movements with precision.*" Pains in limbs and trunk. *FATIGUE OF LOWER LIMBS AFTER SLIGHT EXERCISE.

Thus we see Gels. good in certain stages of post-spinal sclerosis, but perhaps better in spinal exhaustion.

HELLEBORE—NUX MOSCHATA.

Hellebore.—The muscles do not act properly unless the will is strongly fixed on their action. Genitals relaxed, no erections. Remarkable unsteadiness in voluntary actions. Weakness of the feet and tottering of the knees. He could only walk slowly; numbness of the feet, prickling in toes.

NUX MOSCHATA.

Speech.—**Speech and articulation difficult.* Tongue rolls in the mouth, tongue feels numb.

Sexual.—*Debility of sexual system. Desire, with relaxed organs.*

Back.—Bruised pain in small of back and calves, with languor of legs. *Pain near the lumbar vertebræ, as from blows, and as if broken. Pain in small of back when riding in a carriage.*

Extremities.—Pain in left upper *arm* near elbow, as from a hard grasp of the hand. Numbness and fulness of hands; they burn (subjectively and objectively). Hands feel cold and as if frozen, with buzzing in them on entering a warm room. *Legs* numb and weak; feel as if floating through the air. Tingling in toes, sole, and heel. Bruised pain in heel.

Generalities.—* *Great weakness from slight exertion.* * *Great sleepiness runs through all the conditions. Wandering pains, attacking a small spot and returning frequently.* Burning in skin without redness. *Pains, etc., worse in a thunderstorm, cold, wet, or changing weather.*

NUX VOMICA.

Urinary.—°Retention. *PAINFUL INEFFECTUAL DESIRE TO URINATE. °Urine tenacious and turbid, with dirty-yellow sediment. (Vesical catarrh or cystitis.)

Sexual.—* *Orgasm incited by slightest touch of a woman.* Frequent emissions.

Back.—*Constant pain and bruised sensation in dorsal and lumbar regions. Paroxysms of lacerating pain at nape of the neck.* Formication of spine and extremities.

Extremities.—Falling asleep of hands, fingers, arms, legs, feet, and toes. Tremulous weakness of the legs. Numbness or sometimes burning in the soles. Pains as if the shoes were too tight, and as if weary and sore from walking. Dull *numb* pain in heel, as after jumping from a height. Stitches in the soles.

Generalities.—**Stitches like jerkings in various parts, that cause shuddering of the whole body; they shoot simultaneously through the whole body.* Sudden weakness, must lie down.

Skin.—Insensibility of the skin. Violent burning itching of the whole body and various single parts. Crawling from the feet upward.

Oxalic Acid.

Urinary.—Retention; enuresis.

Sexual.—Erections with occipital dulness after sleep. Erections and lascivious dreams.

Back.—* *Weakness in loins and hips, extending down legs.* Pains shoot in same locality, relieved by constant motion. Sense of numbness in the sacrum.

Extremities.—**Numbness from shoulder to tips of fingers.* Sensation as if the hand were dead. Pain in the limbs with weakness and numbness.

Generalities.—Great weakness. Pains, etc., are worse, and return *on thinking of them.* General numbness. Pains of Oxalic acid often occupy a small space (1 to 1½ inch long and size of a quill), sometimes move along this space, sometimes occupy the whole of it. (Eustachian tube, etc.)

Phosphorus.

Stool.—Involuntary (diarrhœa) from paralysis of the sphincter. *INVOLUNTARY STOOL THE MOMENT THE FÆCES ENTER THE RECTUM. **Constipation, difficult stool from torpor of colon.*

Urinary.—*Enuresis* from paralyzed sphincter. Retention.

Sexual.—**Erections day and night.* **Irresistible desire for coition, with sweat and tremulous weakness after the act.* Intense desire, followed by impotence without desire. **Frequent emissions.*

Back.—**Pain between the shoulders.* Great pain and burning in the back and small of the back. Pain in the back, as if broken, impeding all motion. Weakness in the small of the back, as if asleep, while sitting or rising. Paralyzed sensation in lower lumbar and upper sacral vertebræ.

Extremities.—*WEAKNESS, FATIGUE, AND LEADEN HEAVINESS *in all the limbs.* *ARMS *fall asleep; they become numb while working.* Electric pain shooting down right arm to little finger. *GREAT NUMBNESS *of fingers, hands, and arms;* **they fall asleep. Trembling and formication of fingers, hands, and arms.*

Lower.—Gait so unsteady she expected to fall at every step, wihout vertigo. * *Weakness and weariness of legs, especially on ascending steps.* Complete anæsthesia of the lower extremities and body up to chest. Left leg numb from knee to toes, with at times sense of hot blood circulating in it. **Heaviness, weariness, and numbness in feet.* Jerkings and *lightnings in feet.* **Paralyzed feeling in feet.* Pains in soles on walking. Tearing stitches in soles, so that she cannot step on them. Distressing sense of dryness in soles. Crawling in both heels; stitches and numbness in toes.

Generalities.—GREAT EMACIATION (fatty degeneration). *The patient presented the phenomena of ataxia and* much that reminds one of typhoid fever. **Muscles become flabby. Motions involuntary and uncertain, like one struck with palsy.* *GREAT WEARINESS. *GREAT EXHAUSTION FROM ANY EXERTION. *Numbness and prickling in whole body.*

Skin.—Could not pick up a pin from anæsthesia of extremities. Cutaneous hyperæsthesia (painful to slightest touch). Burning and smarting in face. Burning in arms, thighs, and palms. **Formication.* Formication in right fourth and fifth fingers (ulnar nerve). Formication of fingers, hands, arms,

thighs, etc., and of upper body, neck, and occiput, on entering the house. GENERAL ITCHING OVER THE WHOLE BODY. Phosphorus is well indicated for the fatty degenerations and atrophy which set in after paralysis; but it is also useful in earlier stages.

PHOSPHORIC ACID.

Extremities, Upper.—They readily fall asleep. Formication and numbness of extremities. Tearing pains in brachial plexus.

Extremities, Lower.—They fall asleep. Left foot numb, insensible, and dead only on walking. Burning and stitches in soles and heels, with leaden heaviness in them during rest. Heel and ball of toe painful, as if sore, on stepping.

Generalities.—*Formication all over body.* General cutaneous hyperæsthesia. Biting itching here and there all over body. *Weak and prostrated.

Sexual.—*Weakness and irritability of the sexual system. Emissions with lascivious dreams.*

PHYSOSTIGMA.

Physostigma.—On walking feeling of unsteadiness from knees downward, so he had to tread carefully, *especially when the eyes are closed.* He must look to see where he is going. The unsteadiness can be overcome by a strong mental effort. *Constrictive pain above elbow; same above knee. Stiffness in rectus femoris. Flatulence. Languor.*

PICRIC ACID.

Provings of Picric acid are still meagre, and the following, mainly from Allen's *Encyclopedia,* shows no striking analogy to posterior spinal sclerosis. Yet it has produced in physiological experiments both sclerosis and softening of the cord. Cases are reported in which it has greatly relieved both *lancinating pains* and *ataxia.*

Sexual.—*Intense sexual desire with frequent emissions.*

**Terrible erections with restless sleep.* Intense excitement of whole sexual system.

Back.—Aching in dorsal region. Weakness and heaviness in sacral and lumbar regions and extremities, with great languor, specially on exertion.

Extremities.—Shooting pains in left arm, elbow, and hands; left hand goes to sleep; feels as if blood would stop circulating; legs feel numb; feet cold; needle-pricks in legs and feet; numbness in left foot; soreness in ball of foot relieved by walking.

Generalities.—Universal prostration, mental and physical *asthenia.* It depresses and extinguishes all normal irritability.

Plumbum (Metallicum or Aceticum).

Plumbum heads the list of remedies for posterior spinal sclerosis, and is ably seconded by Belladonna. Plumbum, chronic; Bell., acute. Plumbum produces sclerosis throughout the body generally from hypertrophy of connective tissue. It affects markedly the kidney, heart, and spinal cord. We have a beautiful picture of locomotor ataxia. The posterior columns are sclerozed, the optic and third nerves also degenerated, showing the characteristic eye symptoms. True lancinating pains, ataxia, anæsthesia, paræsthesia, etc., are all produced. But Plumb., like Phos., is especially valuable in the last stage of paralysis and atrophy, where so few drugs will be of benefit.

Eyes.—*Sclerosis of optic disk; its outline hazy, disk prominent and bluish-white.* Strabismus; diplopia; ptosis; conjunctiva yellowish or bluish. Pupils dilated, contracted, and varying. Often the pupils are unequally dilated. *Amblyopia; amaurosis.* Bell., *protruding* or sunken. According to Hull's Jahr. the characteristics of *lead amaurosis* are: "The characteristic mode of development; the considerable dilatation of the pupils, which is of unequal extent, and changes with excessive rapidity; the black non-transparent bottom of the eye; and, lastly, the fact that *one* eye never gets blind alone." The right eye often weakens first.

Stomach.—Intolerable lancinating, burning, tearing pains in epigastrium, relieved by strong pressure. *Terrible colic, with sunken abdomen, retracted navel and anus, with constipation.* *EXCESSIVE PAIN IN THE ABDOMEN, RADIATING THENCE TO ALL PARTS OF THE BODY. Pains paroxysmal, worse by touch. Renal colic (?).

Stool.—*CONSTIPATION, *stool once in eight or ten days,* SCANTY BLACKISH FÆCES, *with intense suffering in passing; stool hard, dry, and lumpy.*

Urinary.—Bladder distended and torpid. Retention, fundus rises to navel. Paralysis of sphincter, dribbling, catarrh of bladder, albuminuria, casts, acute and chronic nephritis.

Sexual.—*Loss of sexual desire.* Seminal weakness, complete impotency, sterility.

Extremities.—Paroxysmal, lancinating, neuralgic pains in limbs, worse at night, relieved by pressure. Loss of co-ordinating power quite marked in both arms, especially the left. With closed eyes he cannot touch any particular spot on his face without feeling for it. Analgesia to pricking and pinching in both arms, especially left. Paralysis with atrophy of the affected parts. Analgesia, with anæsthesia of both arms, specially right. Formication, anæsthesia, and various forms of paræsthesia. WRIST-DROP. Paralysis of the hands. Paralysis and atrophy of certain muscles or groups of muscles.

Lower Extremities.—Very evident want of co-ordinating power over the movements of both legs; movements are not adapted to the desired end; walking is very difficult; strikes the heel down forcibly; staggers when walking with closed eyes, and would fall if not supported. LIGHTNING-LIKE PAINS IN THE LOWER LIMBS. Numbness and paralysis of legs. Excruciating tearing pains in soles. Feet feel numb; soles feel soft on touching floor. Pricking, burning, and formication in the soles.

Generalities.—*EMACIATION. Body plump, limbs much atrophied. ANÆMIA; *all symptoms worse at night.* The disease is subject to temporary improvements. **Epilepsy.* **Epileptiform paroxysms.* (These are sometimes seen in cases of

post-spinal sclerosis). *PARALYSIS. (Electro-muscular excitability normal, increased, diminished, or abolished.) Pains often relieved by pressure, but worse from a light touch. Gangrene. Bedsores (?). Atrophy, with fatty degeneration.

SULPHUR.

Sulphur will be frequently more indicated by the general condition of the patient than by particular symptoms referred especially to post-spinal sclerosis. It may be useful to help combat a deepseated dyscrasia, scrofula, psora, or whatever may be present. Sulphur will often help the general nutrition of tissues, and intensify the action of other remedies. Still it has a number of symptoms which may be referred directly to post-spinal sclerosis. The "girdle pains" are represented as affecting different parts of the pody, especially legs and arms. Lacerating darting pains in the extremities. Paræsthesia (burning, itching, formication, etc.) of the skin, particularly of the extremities. Sulphur is mainly used as an intercurrent remedy, unless strongly indicated by the totality of symptoms.

THALLIUM.

Thallium medicinally closely resembles Lead. The last volume of "Allen" contains some provings which bring out this analogy and its applicability to post-spinal sclerosis very markedly. The peculiar neuralgia, colic, paralysis, ataxia, etc., are very like those of Plumbum, and in cases where Plumbum has seemed indicated, but has ceased to act, Thallium has worked wonders. It is earnestly to be hoped that this drug will be well proven. It is comparatively new and little known, but will amply reward diligent investigation and use.

Silicea and Zinc will repay careful study. With this drug we close the discussion of our subject. It is at best but an imperfect sketch, and in part necessarily so, especially in the pathological section. Much therein is contradictory theory; but twenty years hence, should the article be rewritten, we

trust clear positive statement of fact would replace conflicting hypotheses, our Materia Medica would be enriched by new drugs and reliable verifications of the old, the prognosis, now so disheartening, would brighten, and *Homœopathy* rule triumphant.

Article XVIII.

ON THE PHYSIOLOGY OF THE HEART-BEAT.

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Viewed simply from the stand-point of pathology, the heart-beat and its causes assume a very considerable importance. It is self-evident that cardiac physiology must needs be settled before cardiac pathology can be fully understood; while it is just as apparent that the causes of the rhythmical contraction of the heart and the relations of this action to the nervous system are yet mooted points in the physiology of the circulation. Prominent authors and practical physiologists hold widely different views upon these questions.

While on the one hand some, as Flint, still adhere to Haller's doctrine of muscular irritability, according to which, the nerves play no part in the production of the heart-beat and the contraction results simply from the direct excitation of the muscular fibre by the pressure of blood; and others hold the theory of Brücke, which supposes that the aortic valves shut off blood from the mouths of the coronary arteries during the systole, and thus cause the heart to relax from lack of nutrition; on the other hand, a considerable number of prominent authors (Küss, Hermann, Brown-Séquard, Hayden, Rutherford, Lee, et al.), believe that there is a nervous mechanism, yet vary in their views of its structure and action.

It is evident that the question is complicated, difficult, and not to be easily settled. There are many factors in the problem. Each must have its due weight in the solution.

Many experiments upon the heart and its action have now

become classical. In using their results as arguments, however, it must not be forgotten that the greatest weight is due to simple observations upon the action of the heart under various normal conditions,—a point which we think has been too much overlooked, together with the facts themselves,—while those experiments which most nearly resemble normal action stand next in value.

In order to get a clear idea of the questions before us, it is well, first of all, to state the prominent facts with regard to the heart-beat, which have already been established by various physiologists:

1. The heart is an involuntary muscle composed of striated anastomosing fibres or cells. It contains three large sympathetic ganglia and innumerable smaller ones distributed throughout the muscular substance, beside nerves, both sympathetic and cerebro-spinal. Its nervous supply is large (Bidder, Schmidt, Remak, Stricker, Friedländer, Lee).

2. Ultimate nerve fibres are distributed to the muscle cells, to the endocardium, and to the pericardium (Stricker).

3. The heart, even in warm-blooded animals, will contract rhythmically for some time after removal from the body, more especially if blood be introduced (even in small quantity) within the cardiac cavities. A few drops of blood placed in an excised heart, which has stopped pulsating, will cause it to beat again. An empty heart contracts feebly and irregularly. If the valves are destroyed and the heart (*in situ*) is filled with blood, the systole will become more powerful and regular and less frequent than otherwise. When filled in the same manner with water it beats less strongly and more frequently. Other agents will excite the heart to contract, particularly if directed to the endocardium (Flint, Jr.).

If with the heart *in situ*, the venæ cavæ and aorta be ligated, the right ventricle (soon empty) will cease pulsating, while the left ventricle (soon distended) will continue for some time to beat (Flint, Jr.). The heart has been observed to pulsate in fœtuses without a brain or spinal cord (amyelencephalic) (Hayden).

4. An excised heart will not beat after the removal of the sinus venosus (or that portion of the wall of the right auricle not included in the appendix or septum, and which contains the large ganglia of Remak), unless the remainder of the auricle be also removed (Hermann).

5. Contractions may be excited in the excised heart which has ceased pulsating upon removal of the sinus venosus, by puncturing in the region of Bidder's ganglion in the auriculo-ventricular groove (Hermann).

6. Detached portions of the cardiac muscle will often contract in a rhythmical manner (Flint, Jr.).

7. Simple increased intra-cardiac blood-pressure or its immediate cause—increased arterial resistance—will quicken the beat even when all the nerves leading to the heart are cut (Ludwig and von Bezold). Increased vascular resistance if it be not too great will also increase the force of the systole, as is evident in active muscular exertion.

8. The heart has pulsated in the living animal for ninety seconds after both coronary arteries have been tied, and for the first fifteen seconds without slowing or accelerating (Erichsen).

9. Galvanization of the peripheral end of the divided vagus or of the nerve in continuity, enfeebles the systole, slows the pulse, lowers the blood-pressure, and finally stops the heart in diastole. The heart may resume action, however, during the continuance of the current (Flint, Jr.).

10. Inhibition of the heart's action may be produced by reflex, viz., by galvanic irritation of the central end of the divided superior cardiac branch of the vagus (depressor nerve of the circulation), by irritation of the central end of either pneumogastric when alone divided, by irritation of the sensory nerves of the abdominal viscera, or by irritation of the splanchnic or of the cervical sympathetic (Rutherford).

11. Shock generally slows the heart-beat for a longer or shorter period of time after its reception. This is followed by a more prolonged acceleration of the pulse (Jordan).*

* British Medical Journal, vol. i, 1867.

12. Section of the vagi in the neck or of their inferior cardiac branches doubles the number (nearly) of cardiac pulsations and diminishes their power, reducing the blood-pressure very considerably, while the respirations although unusually profound are reduced more than one-half in number. Oxygenation is seriously interfered with. The animal dies cyanotic, and after death the lungs are found engorged with blood (Flint, Jr.).

13. The superior cardiac branch of the vagus (sensor nerve of the heart, depressor nerve of the circulation, or nerve of Cyon), is a centripetal cerebro-spinal nerve having a vaso-inhibitory function. Irritation of the central end after section causes, beside some pain, a progressive diminution of the blood-pressure from dilatation of the bloodvessels (more especially of the abdomen), during about fifteen cardiac cycles; the arterial pressure then becomes stationary at from one-half to two-thirds of the normal amount. The same takes place when both vagi are cut, and also in animals poisoned with curare (which paralyzes the cardiac fibres of the vagus) but kept alive by artificial respiration. These effects continue until the irritation is stopped, and are accompanied more especially at the start by a slowing of the pulse, which disappears during the complete depression of the blood-pressure and is not manifested if the vagi be previously cut (Cyon, Flint, Jr.).

14. Upon cessation of irritation of the nerve of Cyon and during the time that the arterial pressure is regaining its normal stand-point, *i. e.*, during the progressive contraction of the arteries succeeding their paralysis, the pulse is accelerated, beating more rapidly even than before the excitation of the nerve, and this during all the time that is occupied in the return of the blood-pressure to the normal height (Cyon, Flint, Jr.).

15. During active muscular effort the heart-beat is more forcible and more frequent than at any other time under normal conditions. There is a very evident increase of resistance to the flow of the blood from the muscular contraction and consequent vascular compression, and the arterial tension and blood-pressure are therefore materially augmented. Struggles

on the part of an animal to whom a cardiometer is attached show marked and sudden elevations of blood-pressure.

16. Increased cardiac nutrition (as in plethora) will increase the force of the systole, while lessened nutrition diminishes the force and increases the frequency of the heart-beat.

17. Galvanization of the accelerator nerve of the heart (third branch of the inferior cervical ganglion), or of its peripheral end when divided, quickens the pulse and diminishes the length of the systole (as well as diastole) and the force of the contraction (Rutherford, Hayden*).

18. Emotion and pain frequently accelerate the heart-beat and increase its force.

With the facts plainly before us, we can proceed without delay to the conclusions and inferences to be drawn therefrom.

As the heart will beat when removed from the body as well as in cases of amyelencephalic fœtuses, its nervous mechanism, if it have any, must be contained within itself.

As the heart contains an extensive system of ganglia and nerves, as it will not beat if the sinus venosus, which contains the larger ganglia, be removed, as it will pulsate if punctured over Bidder's ganglion, and as there is no other example of muscle working independent of nerves, the conclusion seems irresistible that the heart possesses an inherent nervous mechanism, and that this mechanism is composed of its sympathetic nerves and ganglia.

The old Hallerian theory, that the heart-beat results simply from the muscular irritability of the heart excited directly by the contact of the blood, with its pressure upon the muscular substance, seems at the present day to rest alone upon the immunity of the heart to the poisoning and general muscular paralysis of curare, now that numerous ganglia have been discovered throughout the cardiac substance, which can account for the post-mortem contractions of the heart or detached portion thereof. But, because curare will paralyze the voluntary mus-

* Diseases of the Heart and Aorta, Dublin.

cles without materially affecting the heart's power of contraction, does not necessarily prove that the heart works without a nervous mechanism. The supposition that it does so work takes for granted that curare should affect the sympathetic system of nerves, in the same manner that it does the cerebro-spinal nerves. This seems unwarrantable in view of the facts, that the poison does not affect all of these latter nerves even, leaving the sensors intact while it paralyzes the motors, and that in a curarized animal with complete general paralysis of the voluntary muscles during artificial respiration, the movements of the intestines are even more lively and energetic than in a non-poisoned animal.*

The fact that the heart will respond to blood as a stimulus to contraction longer and more vigorously than to anything else introduced within its cavities, would imply that the endocardium had nerves communicating directly or indirectly with the muscle cells,—nerves that could distinguish between blood and water for instance. An inference that is sustained by purely histological researches (Stricker), which show that there are numerous ultimate nerve fibres distributed to the endocardium, and others distributed to the individual muscle cells; while the fact, noted by Bernard, that the contraction resulting from irritation of the endocardium is more vigorous than that induced by irritation of the pericardium, helps to bear out this view, as well as the existence of a considerable development of nervous tissue in the shape of fine plexuses ramifying between the layers of and underneath the endocardium (Stricker), giving a considerably greater supply of nerves to the endocardium than to the pericardium.

If it be true that these nerves be excito-motor, there is every probability from analogy, that they end in the numerous ganglia located in the cardiac substance, from whence the fibres distributed to the muscle cells must take their origin as from centres of reflection; the endocardial or afferent nerves acting as sensors of the amount of intra-cardiac blood-pressure,

* Von Bœrck, Ziemssen's Cyclopædia of Medicine, vol. xvii.

and thus determining in the most natural manner possible, the amount of systolic force required to empty the heart.

That there is an inherent mechanism which modifies the pulsations according to the work to be done, is rendered probable by the fact, that an increase of arterial resistance will quicken the beat when all the nerves leading to the organ are cut, and will also increase its force, as is shown by the phenomena of the heart and pulse in active muscular exertion. There seems at least to be a strong probability, that the heart possesses an inherent nervous mechanism of sympathetic ganglia with afferent and efferent nerves, which measure and incite the necessary amount of heart-work at each cardiac cycle by an action that may be described as an intra-cardiac sympathetic reflex.

That the cardiac contractions are incited normally by the presence and pressure of blood in the heart-cavities seems to be the only rational view of this action (systole), from the facts, that blood placed within the cavities of an excised heart is the best stimulus to contraction, and that in the living animal one ventricle containing blood will continue to beat while the other is empty and pulseless. Evidently in no other way could the contractions so certainly perform their duty without waste or insufficiency of exertion as when excited by the very load they have to lift.

The unexplained persistence in excised hearts of rhythmical contractions after the organ is empty, may be attributed, to the irritation of the cardiac surface, by evaporation of moisture and consequent loss of heat and drying, or by contact with foreign substances, as air or the table upon which the organ lies, or to excitation from division of the sympathetic nerves leading to the heart.

The diastole of the heart is most naturally attributed to the cessation of excitation by the blood. This, however, can not be the only reason, or even the main one, as the heart will beat when excised and empty. It cannot result from muscular exhaustion for the same reason, and also because the contractions

will continue for over a minute after ligature of both coronary arteries; while the heart may remain in tonic contraction even after death. It certainly is not due to any action of the vagus or of any extraneous nervous centre.

From a consideration of all the facts which bear upon the point, it seems that there must be an inherent act of inhibition connected with or dependent upon the completion of contraction. This may or may not require a special inhibitory nervous mechanism. The extreme pressure at the end of the systole may have an inhibitory or paralyzing effect upon the many ganglia located in the ventricular substance, with or without a special mechanism of arrest.*

The uniform power of strong electrical currents, when applied to the pneumogastric nerve in continuity or to its peripheral end after division, to stop the heart's action in diastole, or when milder to slow the pulse, to diminish the force of the heart-beat, and to lessen the blood-pressure, as well as, the great acceleration of the pulse which results from cutting the nerves in the neck or from paralyzing the motor fibres of the vagus by curare,† have given to the vagus the name of the inhibitory nerve of the heart. This view is borne out by certain cases of sudden death from shock without lesion discoverable *post mortem*, by the slow pulse of recent shock,‡ and by Goltz's experiment on frogs.§

* That there is such an apparatus, however, seems probable, when we consider the result (renewed pulsation) of cutting the auricles entirely away after the heart's action has been stopped by removal of the sinus venosus.

The theory would require the presence of ganglia in the auricular walls, whose inhibitory power would be insufficient to overcome the combined motor force of the ganglia of the sinus venosus (Remak's), of the ganglion of the auriculo-ventricular groove (Bidder's), and of the intra-muscular ganglia of the ventricles, yet which could master that of the latter two. Such a mechanism might require a paralyzing pressure upon the ventricular ganglia, like that which takes place at the end of the systole, to enable it to act.

† Von Bœrck, Ziemssen's Cyclopædia of Medicine, vol. xvii.

‡ Furneaux Jordan on Shock, British Medical Journal, vol. i, 1867.

§ In which the intestines are bared to view and struck with the handle of the scalpel, when the heart suddenly stops, while in another frog, where the same is done after section of the vagi, the heart does not cease nor modify its action. It is an example of reflex inhibition.

The fact, however, that normally, except during active muscular exertion,* the slower the pulse the more powerful it is, and the faster it becomes the weaker it grows, as well as the fall in the blood-pressure which ensues upon section just as upon irritation of the vagus, leads us to question whether the normal constant function of the vagus is to weaken while slowing the heart-beat, or whether it is not simply to diminish the pulse-rate (allowing the cardiac sympathetic and the depressor nerve to regulate the force of each stroke according to the amount and pressure of blood in the ventricles at the beginning of each contraction), while it defers to rare and abnormal occasions, such as that of shock, the abnormal paralyzing action, which is experimentally simulated by strong galvanic currents. The latter view is certainly the simplest that can be taken of the normal action of the vagus and evidently should have the preference, if it cannot be shown that the vagus weakens as well as slows the heart-beat under normal conditions. As there is no proof of this, and as section of both nerves or paralysis of the motor fibres by curare will not strengthen but greatly weaken the force of the systole and will materially reduce instead of heightening the blood-pressure, the idea that the vagus acts normally upon the heart as anything more than a mere retarder of its action, seems improbable as well as unnecessary. This conclusion, moreover, is borne out by an experiment of Flint's† (undertaken for another purpose), in which galvanization of the vagus before its motor fibres had become completely paralyzed by curare in a dog (whose heart had been previously exposed and promptly arrested by a moderate current of electricity), required as usual in this kind of poisoning to be powerful before the heart's action was affected, while *a weaker current* diminished the frequency and *increased* the *force* of the pulsations.‡

* For an explanation of which, see later.

† Textbook of Human Physiology, 1st ed., p. 61.

‡ An effect of weak currents, which is *not* noted by writers in speaking of the galvanic irritation of the vagus in the *non-curarized* animal. In a recent experiment undertaken by Dr. C. W. Cornell and the writer to

The reason for this seems to be, that, as curare diminishes the nervous irritability of cerebro-spinal motor nerves, and therefore renders them less susceptible to electrical irritation, we are able to excite less action of the vagus when the fibres in question are partly paralyzed, than we can (with the weakest current that will overcome the great resistance of the tissues) when the fibres are not poisoned and not so unsusceptible to galvanic irritation. Currents of electricity in the latter case seem too strong, too different at least from normal nervous impulses to produce anything but abnormal action, while weak currents in the curarized animal apparently come nearer to the normal action of this unusually excitable nerve.*

The point is an important one, as upon it hinges our view of the vagus as normally a true inhibitory nerve of the heart or a mere retarder of the cardiac rhythm.

Further experiments to positively settle the point become very desirable; their performance, however, needs a very considerable amount of skill, time, and patience, as well as unusual facilities for physiological work. Results which shall be positive one way or the other, need, from the delicate and difficult nature of the experiment, a more or less lengthy course of experimentation.

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determine *this* point, it was found that even the current from one standard chloride of silver cell would distinctly cause the typical depression of the blood-pressure, while the hand placed upon the heart felt a distinct diminution of the force of the systolic contraction.

The animal, a moderate-sized dog, was etherized, the vagi were then lightly encircled with wires from the positive pole of the battery, while a Magendie's cardiometer was attached to the right carotid. The pleuræ were then opened and artificial respiration employed to abolish the great effect upon the blood-pressure of the changes in intra-thoracic pressure resulting from normal respiration; the negative pole was applied to the apex of the heart by the hand; the blood-pressure was noted, and the current of one cell allowed to flow, when the mercury almost immediately lowered about an inch, and the systolic contraction grew weaker.

* That the vagus is an unusually irritable nerve seems to be proved at once by Flint's experiments, which show that for some time after the motor erves generally are paralyzed in a curarized animal, the pneumogastric emains excitable, although much less so, as we have seen.

From the results of section of both nerves, it is very apparent that the vagus (or that portion which directly affects the heart) is constantly in action; but as yet, it is impossible to say what it is in the organism that keeps up this constant action of the pneumogastric upon the heart, or varies it according to the needs of that organ in the different moments of exertion, emotion, and repose.

From the effect of irritation of the central end of the divided nerve of Cyon in causing a marked diminution of the blood-pressure by reflex* dilatation of the bloodvessels (principally abdominal), we are led to call it a vaso-inhibitory nerve and to believe that it automatically regulates (equilibrates) the intra-cardiac blood-pressure by relaxing the normal tonic semi-contraction of the arteries more or less, and thus diminishes or increases the obstruction to the flow of the blood and the amount of heart-work necessary to overcome it. The nerve acts as a conservator of heart-force. It prevents unnecessary waste.

The diminution in the frequency of the pulse, which obtains upon irritating the central end of the divided nerve of Cyon by galvanism, is evidently due to a reflex stimulation of the vagus, as it is not manifested when the vagi are cut.

Decreased arterial resistance to the flow of the blood will cause, a diminution of the force of the systole, as is evident from the experiments upon the nerve of Cyon, and also an acceleration of the heart-beat, which is observed during the period of time when the blood-pressure is still depressed, but slowly returning to the normal standard after the passage of the galvanic current through the central end of the nerve has ceased; previous to this there is a slowing of the heart-beat, which has been shown to depend upon a reflex stimulation of the vagus that ceases of course upon the stoppage of the current.

The normal increased resistance to the flow of the blood which we find during active muscular exertion will increase

* Reflex from this nerve through the centre to the vaso-dilator nerves.

both the force and frequency of the heart's action. This, while contrary to the general rule of the pulse, seems to be easily explained by the theory, that, owing to the acceleration of the blood-current and the increase of pressure in the veins, which is due to muscular contraction and compression, the heart during the diastole is rapidly distended and excited to action.

Abnormally increased resistance, as in the general vascular obstruction of apnœa, greatly increases the force of the systole while the number of pulsations is materially diminished. The latter is probably due to stimulation of the vagi by carbonic acid (Traube).

Decreased cardiac nutrition, which implies lessened heart-power, diminishes the force of the pulsations and increases their frequency, evidently for the reason that the heart is feeble and cannot therefore lift so great a load at each systolic stroke. It hence must beat more often.

The function of the accelerator nerves seems to be that of affording a nervous channel for those impulses which accelerate the heart-beat; impulses which may be the result of emotion, pain, or even shock perhaps (after the primary slowing of the heart-beat).

To recapitulate the conclusions and inferences drawn, we would say:

1. That the heart possesses a nervous mechanism composed of inherent sympathetic ganglia, with afferent nerves leading from the endocardium and efferent fibres distributed to the muscle cells.

2. That the cause of the rhythmical contraction of the heart (systole), is the presence and pressure of blood in the cardiac cavities, and the excitation of the nerves of the endocardium which lead to the cardiac ganglia, while the force of the systole is by this mechanism automatically proportioned to the amount of distension and the arterial resistance to be overcome.

3. That the cause of the diastole is probably the extreme pressure at the end of the systole upon the intra-cardiac excito-motor nerves and ganglia, together with the cessation of excitation by blood in the cardiac cavities.

4. That the vagus is a simple constant retarder of cardiac action under normal conditions.

5. That increased frequency of the heart's action when strong is probably due to increased pressure in the venous system and rapid distension of the ventricles during the diastole.

6. That the function of the superior cardiac branch of the vagus (nerve of Cyon) is to dilate the bloodvesssels by reflex action upon the vaso-motor nerves, and thus to diminish the arterial resistance in accordance with the needs of the heart for lessened work.

7. That decreased arterial resistance will cause a diminution in the force of the heart-beat with an increase in its frequency.

8. That the acceleration of the pulse in asthenia is directly due to the diminished heart-power.

9. That emotion, pain, and shock (in its second stage) in all probability increase the frequency of the pulse through the accelerator nerve of the heart.

Article XIX.

ON SYPHILITIC NERVOUS AFFECTIONS.

BY GEORGE W. BLODGETT, M.D.

Numerous and exhaustive treatises have been written upon syphilis of the nervous system, and yet much remains to be learned. Within the past two decades, however, great advances have been made in this field of labor, and diseases which were formerly looked upon as obscure and hopeless, and classed as to etiology under the head of idiopathic, have been found to fall within the domain of syphilis and to be attended by a

prognosis so much brighter and more hopeful than was at one time the case, that one of the most gifted minds which has adorned the literature of genito-urinary surgery has written, "That the prognosis is better as a rule for nervous symptoms caused by syphilis, than for the same symptoms depending upon lesions equal in extent, caused by another malady of the nervous centres."

This being the case it at once appears how important it is that we should be able to recognize those affections of the nervous system which are syphilitic in their nature, and distinguish them from similar conditions into which the element of syphilis does not enter.

Appreciating this necessity, it is only purposed, in this paper, to develop and place in order, concisely and briefly, certain clinical and practical facts already known, while it is not hoped to contribute anything new or original to the literature of the subject.

Symptoms of the nervous system having syphilis for their cause are produced by lesions of the bony envelopes of the nervous centres,—cranium or vertebral column; by lesions of the enveloping membranes,—dura mater, arachnoid or pia mater; or by lesions of the substance of the brain or cord,—in their nature diffuse parenchymatous inflammations or gummy deposits. Besides these there also exists syphilis of brain or cord, *sine materiâ*, so called, where no apparent lesion is found after death.

The *modus operandi* of the production of these symptoms by lesions having their seat in the structures referred to, has been so thoroughly discussed in the monographs and textbooks upon the subject as to necessitate no reference to it here. Yet thorough and exhaustive as are the standard textbooks, there are connected with the subject certain points of great practical interest which they too often fail to notice at all, or noticing them only slightly; impress but little upon the mind of the reader.

That morbific poisons, tainting the blood current, frequently produce congestions of nervous centres, thus giving rise to a

train of nervous manifestations more or less severe, is a fact no longer to be denied. This then being the case, it would seem, and it is indeed well borne out, that cerebral congestion is the only pathological change existing in many of the earlier* conditions of nervous syphilis.

Studying the records of autopsies, it is deduced that the earlier a nervous symptom of syphilis occurs, let that symptom be paralytic or otherwise, the less likely is there to be any lesion which an autopsy would reveal. Moreover, study in this field has taught us, that in any individual case, there exists no constant relation between the character, position, and severity of the lesion, and the character, position, and severity of the nervous symptoms to which the lesion may give rise. In other words, the most skilled and competent observers have found the nervous centres perfectly sound when nervous symptoms preceding death have been of the most serious character, "hemiplegia, perhaps, with paraplegia, aphasia, dementia, mania, general paralysis, symptoms of softening, etc., all and many others which might be quoted, going on to a fatal termination." Again, death may ensue, revealing fearful destruction of certain portions of brain and envelopes, clearly syphilitic, and severe pain in the head have been the only nervous symptom.

Nervous symptoms depending upon syphilis may appear within the first few weeks after infection or at any period later during the life of the patient, but the later the nervous manifestations the more probable the existence of tissue changes.

Let these changes exist or not, or existing, let them be what they may, it will be evident from what has been written, that he must be more than a perfect diagnostician who having a given group of nervous symptoms will designate the causing lesion.

While then we cannot say what the lesion is, in each case, yet we should, by observing certain symptoms, be led to suspect and look for the syphilitic element in those cases where it exists. Here, again, the textbook is exhaustive, and only leaves

* Here the term *earlier* refers to the period after infection when symptoms become manifest.

for us the grouping of certain symptoms bearing upon the diagnosis in certain conditions. Important among these is syphilitic hemiplegia. How easy and how natural it is to look for other causes for this affection, especially when it occurs rapidly, and with a sudden onset? But syphilitic hemiplegia occurs as a rule, without loss of consciousness, even when the attack is sudden; again, differing from hemiplegia, having a different cause, our patients will usually be under forty years of age, and the loss of motion will generally be gradual, constant fixed headache having for some time preceded the attack.

As in syphilitic hemiplegia, so in syphilitic paraplegia, the onset of the paralysis is usually gradual. The loss of motion will rarely be complete, and there will often be no local symptoms to call the patient's attention to the injured portion of the cord. The bladder will always suffer and demands local treatment. Paraplegia may be a manifestation of inherited syphilis.

Another and not very infrequent affection to which peculiar interest attaches here, is the so-called syphilitic epilepsy, more properly designated epileptiform convulsions, having syphilis for their cause. Realizing how almost precisely this trouble simulates epilepsy, and how almost universally it may be mitigated or cured while epilepsy itself is seldom curable, the following points of differential diagnosis cannot fail to be of interest.

Syphilitic epilepsy will usually be found to occur in patients who have not had epilepsy in early life, and who are past thirty years of age. The attacks are liable to be preceded by headache, and the convulsions occur often, that is many in quick succession, the interval between the series of attacks being comparatively long; during which periods of quietude, however, headache or other nervous symptoms exist and become aggravated, conditions contrary to what obtain in non-syphilitic epilepsy. More than this, syphilitic epilepsy is liable to be associated with or followed by some form of paralysis.

Certain important points bearing upon the whole subject will be found to be embraced in the following remarks. They

are important, as they will in many instances of obscure nervous symptoms be found to lead to a suspicion of syphilis, which being followed out and confirmed, the most happy results as to treatment will ensue.

Syphilis, when producing intellectual disturbances, may very frequently be a cause of aphasia.

Paralysis, when involving single muscles or sets of muscles, frequently owes its existence to syphilis.

Mydriasis, when existing by itself or with other signs of perverted nervous action, is frequently an evidence of syphilis; the eye itself of course being not diseased.

Failure of the memory is a common symptom of nervous syphilis, as are also many other mental disturbances, from the slightest hallucinations and illusions to complete insanity, none of which conditions are of necessity, however, accompanied by paralysis.

In marked abnormal and inordinate emotional expressions, accompanied by mental weakness, syphilis is often the first cause.

Brown-Séquard has justly remarked "that the disorderly grouping of nervous phenomena should lead us to interrogate syphilis as a cause, as paralysis of some muscle of the eye and paraplegia, or paralysis of one hand and the other foot, etc."

Gout may manifest itself in the form of congestion of nervous centres, and thus produce symptoms precisely similar to others produced by syphilis.

"Many an individual, seemingly overpowered by heat on a summer's day, has in fact an explosion of pent-up nervous syphilis, which goes unrecognized and leaves him with impaired brain power, high emotional excitability, some loss of memory, and perhaps some positive paralysis, for all of which the sun gets credit, and no effort is made to combat the syphilitic cause."

Full and comprehensive directions for the treatment of nervous syphilis will be found in the textbooks; it will consequently be only necessary here to epitomize what is there developed in detail.

"No symptoms of nervous syphilis, however alarming, need necessitate a fatal prognosis." "Some cases seem almost to

rise out of the grave under the influence of the Iodide of potassium." This remedy, pushed rapidly to toleration, unless the symptoms subside before this point is reached, is the main line of treatment. Mercury, given with the Iodide, is often of great value in severe or protracted cases.

"In the treatment of nervous syphilis the delicate nature of the tissues involved must always be borne in mind. The greater the promptness of action the more efficient the treatment." In those forms of disease which occur early after chancre Mercury alone is called for, but even here the Iodide should be held in readiness. "It is the latter agent which most quickly controls the symptoms in desperate cases, *not in mincing* therapeutic *doses*, but in specific doses of ten to twenty grains, commencing at which the remedy should be run up as rapidly as the stomach will bear it, until the symptoms are stayed and forced to retreat. This result may be confidently counted upon in all cases where the diagnosis is accurate and treatment is not commenced too tardily and pushed indolently, if the stomach is sound. The effect of Opium upon pain is not more wonderful or more striking than is that of the Iodide of potassium upon the nervous manifestations of syphilis."

Destroyed or indelibly injured nerve tissue cannot be reproduced by treatment, and in many cases, especially where treatment has been delayed, certain functional disorders will remain which treatment cannot affect.

After having carefully reviewed those cases of nervous syphilis recorded in all the publications of the different schools to which access could be obtained, we feel warranted in stating that the Iodide of potassium and Mercury (not in small doses) are the only remedies upon which reliance may be placed.

Our own fallibility in selecting remedies upon the law of similars, the delicate nature of the structures involved, the dangers of delay, the almost universal certainty of affording relief through the heroic use of the Iodide, aided in some cases by Mercury, all imperatively urge us to pursue no other treatment. Lastly, change of air and surroundings frequently influence treatment to a marked degree and may be essential to success.

Gleanings from Foreign Journals.

ARTICLE VIII.

ELECTROLYTIC FISTULAR CAUTERIZATION.

A NEW METHOD OF GALVANO-PUNCTURE.

Translated from the French of A. Tripler.*

BY MAYHEW SWIFT, M.D., BROOKLYN MATERNITY HOSPITAL.

WHATEVER the method employed, cauterization has, up to the present time, always been a superficial operation.

Neither intensity of current nor prolonged application have been able to do away with this characteristic, which remains even when the operation is applied to fistulous tracks, or to cavities communicating with the surface.

The same is the case, when the galvano-cautery is used in operating upon osseous tumors subcutaneously, with a view to cause their resolution. The result has been merely to carry on beneath the skin an action, which is still in reality superficial.

M. Jules Guérins's idea of effecting in such cases a subcutaneous cauterization by means of needles insulated nearly to their tips is but a new attempt in the same direction.

The method of cauterization, however, which we advance in this paper, has a different result in view, namely: *the establishment of permanent fistulæ*, in order to convert closed cavities or cysts, containing morbid products, into cavities communicating more or less freely with the surface.

The method is less liable to danger than those ordinarily used for this purpose, and enables us to effect results with the trocar, or sometimes even with the needle, which, otherwise, can often only be accomplished by the use of the bistoury; but beside this mechanical use, electrolytic cauterization pos-

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* La Cautérisation Tubulaire. Paris. Octave Doin, 1879. Extrait du Bulletin de Thérapeutique Médicale et Chirurgicale, Numéros des 15 et 30 Juillet, 1879.

The term cauterization is used to signify *destruction* of *tissue*, as well by electrolysis as by the moxa.

sesses at the same time an action, the future capabilities of which we cannot, as yet, foresee; an action, whose power is displayed in causing such modifications in the nutrition of pyogenic membranes and certain cyst-walls, that resolution of the morbid products is brought about; a result, which renders the classic operation of tapping a mere palliative or preliminary procedure.

The operation consists in introducing into the cyst or collection of fluid a trocar, which is then constituted a negative electrode, and so acts upon its surrounding tissues by its electrolytic power that the track made by the trocar is rendered persistently pervious.

Results the same, or very similar to those I have in this manner intentionally sought, have before now been accidentally produced under conditions, which differ, alike with those I have detailed, from any method of cauterization now in use.

When galvano-puncture has been employed in order to localize more precisely the action of a current, from which dynamic effects alone were sought, *deep*, instead of *superficial linear* cauterizations have sometimes been produced.

This result did not, at first, appear to point out an addition to the surgeon's resources. In fact, so long as the true theory of electrolysis was not established, cauterizations by galvano-puncture were considered to be accidental, and the fact of their occurrence generally suppressed.

Schuster seems to have been the first to remark, after applying galvano-puncture to hydrocele, the constant presence of this kind of cauterization, as well as to suggest that its influence might aid in effecting the result of the operation by superadding resorbent action to the catalytic process, which is set up by the current.

Since then, galvano-puncture has seemed to me to be an advisable method for opening into accumulations of fluid, which it was not desirable to evacuate rapidly. It is a method, less liable than any other to the occasional bad consequences of operations by incision, and certainly less liable than those by the bistoury or trocar to subsequent ulceration of the skin

around the outlet of an abscess, while it has the advantage of leaving scars that are insignificant, or even imperceptible.

Galvano-puncture with a needle has served me very well in the two following cases; one a thecal cyst, the other a sublingual abscess.

CASE I. *Ganglion of the Dorsal Surface of the Wrist.*—A young woman, of about twenty years of age, came to my dispensary, having a ganglion on the dorsal surface of the wrist, the size of a hazelnut, not reducible by compression. Exploratory puncture yielded a gelatinous fluid. At the end of fifteen days, the patient was operated upon with a steel needle, the circuit being completed at the palm of the hand, during a seance of twenty minutes. The wound was dressed with lint. Patient returned in eight days. No trace of the tumor evident. The eschar at the site of the puncture had began to separate. At the end of six months, no trace of tumor was discernible, except the scar resulting from the puncture, which was represented by a small white spot, four millimeters in diameter.

CASE II. *Sublingual Abscess.*—A young woman, of about thirty years of age, of lymphatic temperament, felt, while eating some salad, a pricking sensation beneath the tongue, which she thought was caused by part of a splinter that had not been entirely removed. The locality immediately became the seat of pain and swelling, which increased more and more, and led successively to enlargement of the submaxillary glands, an abscess of the left tonsil (at the end of the second week), and an almost complete dysphagia, so that she could only swallow liquid food, and this through a tube. The attack was accompanied by fever.

The febrile movement subsided, but the swelling of the supra-hyoid and submaxillary regions appeared like a single tumor, hard and raised, in which there was but a faint point of fluctuation, and that over the centre of the supra-hyoid region, slightly to the left of the median line.

About one month after the accident, galvano-puncture at the centre of the small fluctuating point was performed because of the lessened liability to inflammation attributed to it.

A gold needle was inserted to a depth of 1½ centimeters during a seance of fifteen minutes. The circuit was closed with the negative pole in the left hand. The current varied from four to five millivebers. The wound was dressed with simple cerate. The operation was followed with immediate relief. The contents of the tumor oozed little by little from the track left by the needle-electrode for some days. Five days after no trace of fluctuation could be found. The point where the splinter entered was scarcely distinguishable. The whole of the affected portion remained somewhat swollen and hard, but sensibly diminished in size. Deglutition was easy. All pain had ceased. Resolution advanced rapidly. Five decigrams of Iodide of potassium were given daily. Five weeks later resolution was complete. A white spot two millimeters in diameter showed the point of puncture.

In order to avoid the subcutaneous burrowing which so frequently follows the use of the bistoury in opening buboes, I formerly advised cauterization with a negative *cultellaire* electrode. Instead of this method, of which the advantages are partly offset by its slowness and painful nature, I would now employ my method of negative galvano-puncture.

Hitherto, however, no opportunity has presented itself. I should proceed in like manner in evacuating cold abscesses.

It is proper here to note a point of interest, upon the importance of which I shall presently insist.

When a cyst or an abscess is operated upon by the ordinary puncture (by trocar), either simple or followed by an injection, the orifice opened by the instrument is always used to give immediate exit to as much as possible of the morbid product. In our method of galvano-puncture it is not necessary to take such care. The cure is effected by a double process. The fistulous track made at the operation allows the escape, little by little, of the contents of the tumor. But the most important curative action perhaps, is the effect upon the nutrition of the internal surface of the cyst-wall or pyogenic membrane, which action is kept up without interruption by the electrolysis.

The precise manner of accomplishment of this modification

of the cyst-wall or pyogenic membrane yet remains undetermined, and, doubtless, varies with the nature of the tumor and its contents.

Linear cauterization along the track of a needle, however, is but a limited application of a general method, which, while supplying the beneficial action of cauterization, also opens up avenues of *any diameter* for the exit of morbid material.

My first operations of this kind were performed on sebaceous tumors. They differed from ordinary galvano-puncture only in the calibre of the trocar being larger than that of the needles generally used. The puncture having been made the trocar was withdrawn and a moist tent inserted, which served as a negative electrode, when, according to the shape and requirements of the tumor, the circuit was closed either in the growth or at a distant point. For instance, in tumors of the head or neck, the circuit was closed in the hand, so as to distribute the force of the current; while for tumors of the extremities or back the circuit was closed at a neighboring point.

It is hardly necessary to remind the reader that the resistance of the intervening tissues varies according to the distance between the electrodes, and that the tension of the current must be increased in proportion to increased resistance.

When the operation is over care must be taken lest the opening in the eschar should gape, which will be almost sure to occur if it should become dry. To avoid this accident it will be sufficient to retain the moisture of the part by a bit of lint covered with cerate placed over the wound.

I have used this method on an ovarian cyst, into which a rubber sound eight millimeters in diameter could be introduced eight days after the operation. I will not lengthen this paper with the details of the operation, which were first communicated to the Academy of Sciences in May, 1879, and afterwards published in the *Gazette Obstetricale.* The patient, who was at death's door when operated upon, returned in a few days to her home, soon resumed her ordinary activity, and went out three weeks after the operation. The permanent fistula having been maintained as much for the purpose of daily

injecting Iodine, as to permit the passage of caustic sounds in case some of the smaller cysts should develop. These latter occasioned a second operation some seven months after. This was performed while the patient was suffering from intermittent fever, complicated probably with hepatic colic, and was followed by more serious consequences than the first.

For five months there was an abundant discharge from the fistula, which was no longer serous but purulent. Convalescence was finally established, and the condition of the patient daily improved, the hepatic affection being the last to yield. To-day (April, 1879) the fistula is closed and her general condition very satisfactory.

As for the tumor remaining, we await further developments before again operating.

Among conditions to which fistular cauterization is applicable there are two which were indicated in my paper on ovariotomy. They are conditions in which the urinary or biliary bladder is to be opened, the latter in grave cases of biliary calculi. But these are operations of the future, which will require preliminary study before they can be undertaken. There are other applications of the method, however, which can be immediately realized. I need only mention them to make their advantages appreciated; and first in importance is to be noted the opening of cysts and abscesses of the liver. The puncture can be made just as soon as the indications call for it. Serous or sero-sanguineous cysts of the neck are amenable to this process, without fear of those serious reactions which too often follow injections of Iodine given immediately after simple tapping.

Among abscesses which require especial precaution and present exceptional danger, and which call more particularly for this method of opening, may be mentioned perinephritic and prostatic abscesses.

May it not be possible that in opening abscesses on the margin of the anus by this method, we can sometimes, perhaps often, avoid establishing permanent anal fistulæ, a thing which

seems to most surgeons an almost inevitable consequence upon the use of the bistoury. Again, the opening of cold abscesses by fistular cauterization, or even by ordinary galvano-puncture, will be, I believe, a very beneficial operation. The brilliant result obtained in the complicated case above related, leads us to hope that hereafter the treatment of such cases will be simplified, while at the same time their duration is lessened.

The formation of visible scars can also be avoided.

The liability to recur, which abscesses of the labia majora possess, when opened by the bistoury, is an indication for the use of fistular cauterization. The operation would not interfere in any way with the ordinary mode of life of the patient, and doubtless would render it possible to avoid the large incisions with their resulting suppuration which are necessary to-day in order to secure non-liability to recurrence.

The results of superficial galvano-cauterization in cases of ranula have been very satisfactory. Fistular cauterization would give as advantageous results, and would accomplish them more easily, more rapidly, and with less pain. One sitting would suffice, where several are now required.

Finally, fistular cauterization should be studied as a mode of thoracentesis. Of all kinds of tapping, that of the pleural cavity has been most studied. Its successful execution is viewed with much interest. I need not recall the precautions that it requires,—precautions which are for the most part secured by the process I am recommending. It is also a question whether the dynamic action of fistular cauterization would not stimulate the process of absorption. The fact has been proven by Schuster in hydrocele. Might not the same process take place in the pleural cavity? *A priori*, it is at least admissible.

The dynamic action of electrolytic galvanization apart from its surgical effects, is deserving of consideration. By whatever name we call it,—substitutive irritation or otherwise,—it is certain that it favors, in a remarkable manner, the absorption of certain collections, and in a more general way, the nutritive processes of certain benign tumors. Among the latter, there

is one—the sebaceous—whose study from this standpoint has special interest on account, of its comparative frequency, of its various conditions, and of the possibility of comparing the results of electrolytic cauterization with those of powerful caustic substances which are to-day becoming so popular.

About twenty-five years ago a teacher of mine (Baudens) had a cook who had an enormous wen. Its upper border was in the temporo-parietal region. The tumor rested upon the shoulder. Its middle portion occupied the left side of the face and neck. Baudens offered to cut it out, but the man could not bring himself to submit to the operation.

He afterward applied to Jobert, and with like result. Two or three years afterwards I saw him. He had gotten rid of his tumor, and there only remained at the lower portion of the parotid, a fistula, which, however, was the seat of sharp pain.

I learned that after seeing Jobert he had applied to a peasant, who undertook to cure him without the knife. The man dipped a match in a yellowish liquid, that I afterwards learned to be Nitric acid of moderate strength, and with a boring motion, applied it to a point on the tumor. After three or four sittings, at varying intervals, the skin was perforated and the tumor evacuated. Some time after this the same liquid was applied over a rather large space around the fistula.

I applied Iodine injections and faradization for several sittings, and cured the fistula.

Since then I have employed this treatment upon many wens, and always with good results. By using the concentrated acid, a single sitting of five to ten minutes is enough to cause perforation of the skin. The tumor very soon diminishes in volume without the occurrence of any appreciable discharge. The application of the acid over the integument is needless. After a period varying from two to four or even six weeks, there escapes from the fistula a hard, horny, semitransparent mass. This is followed by cicatrization in two or three days.

Sometimes, for the sake of comparison, I have used alkaline caustics, producing a very small eschar at the summit of the tumor with Vienna paste. The results have been the same.

In other regions than the scalp, I have preferred using negative electrolysis, penetrating toward the base of the tumor with a *mousse* electrode in my first operations, but later, introducing a trocar as an electrode. The two methods of procedure have given me similar results, which differed, however, from those I have obtained with small sebaceous tumors of the scalp.

Eight or ten days after the operation, the tumor on pressure empties like a boiled chestnut; when nearly evacuated, there appear shreds of white membrane, rather resistant, though somewhat soft, which can easily be extracted with a pair of forceps.

Do the differences which I have noted in the mode of evacuation of these tumors result from the processes employed? The comparative experiments made on small sebaceous tumors of the scalp with Nitric acid, and with Vienna paste, seem at least to show, that all does not depend on the acid or alkaline reaction of the caustic.

Do these differences result either from the different regions operated upon, from the relative size of the tumors, or from the texture of the surrounding tissues? These are points which further experience ought to clear up without much difficulty. Recently, in a man about forty years of age, I operated upon a sebaceous cyst in the temporal region, which appeared to arise from under the zygomatic arch. It ascended about four centimeters higher, and had a breadth about equal to its vertical diameter. The swelling was sufficient to cause pain on moving the eyelids.

The tumor very nearly emptied itself at the time of the exploratory puncture, while the trocar was being withdrawn to give place to a probe which was to serve as a caustic negative electrode. The passage of the continued current in the head soon brought on syncope, so that cauterization with a positive electrode in the tumor and the negative electrode in the hand was used instead. A current of three millivebers was allowed to flow for fifteen minutes.

The next day the tumor appeared of its previous size, but soon diminished. Seven days after the operation, the point

looked like the elevated cicatrix of a recent boil. All tumefaction had subsided. A month thereafter the certainty of the cure was apparent.

In this case nothing was evacuated but the pultaceous contents. How had absorption taken place? What became of the cyst-wall? Did it remain or disappear? Did its sides adhere? Had a relapse occurred, there would have been an opportunity to decide the latter, although not the former questions.

TABLE showing the mean weight and specific gravity of clot deposited per minute by a current-strength equal to the one-hundredth of a weber, by J. Dixon Mann, M.D., in *British Medical Journal:*

Metal Forming Electrodes.	Weight of Clot in Grains. Recent.	Dry.	Loss per ct. on Drying.	Specific Gravity.
Platinnm, ...	.1397	.0333	76.163	1.025
Steel, ...	.1092	.0408	62.683	1.140

Mean temperature, 69.5° Fahr.

The conclusions drawn from a number of experiments, conducted after the methods above indicated, may be briefly epitomized. *The rate of clot-formation is in direct proportion to the current-strength.* With a complex fluid, like blood, there is great difficulty in ascertaining this proportion with precision. Without great care the means taken to keep the fibrin in solution introduce errors seriously affecting the results. *The specific gravity of electrolytic clots is inversely proportional to the strength and to the density of the current.* There is, however, practically little difference in the general character of the clot produced within the limits of current-strength usually employed in the treatment of aneurism. Clots formed on platinum wires were found to be more bulky and of greater weight, but of less specific gravity, than those formed under like conditions on steel wires. The increase in bulk is due to porosity of the clot produced by the presence of free oxygen. When steel wires are used the nascent oxygen combines with the iron. On reference to the table it will be seen that clots deposited on steel needles after desiccation exceed in weight those deposited on platinum. The excess in weight is produced by oxidation of the anode and by the consequent presence of oxide of iron in the clot. With a weak or medium current clots formed on steel wires are more friable than those formed on platinum. When the current-strength is great (.05 weber), the deposit on steel wires is pasty.

Platinum clots, when moist, bear a considerable amount of pressure without disintegration; steel clots, on the contrary, break up under moderate pressure. This difference exists in clots produced by medium currents. With the use of steel needles the current-strength rapidly diminishes, owing to the oxide of iron formed on the anode setting up a counter electro-motive force, which opposes the battery-current; with platinum, or thickly gilt steel needles, the polarization is comparatively slight.

Clots deposited from blood at 60° Fahr. are not so dense as those deposited at the normal temperature (98.4° Fahr.), the rate of deposition being the same.

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JOHN BUTLER, M.D., Editor.

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Editorial.

HAVING received a number of letters of inquiry from subscribers, relative to the choice of batteries for different purposes; asking information both as to the necessary equipment of a specialist's office, and as to recent improvements in electrical instruments, etc. As these are matters in which a large proportion of the younger members of the profession are necessarily interested, we propose to take up a consideration of the questions in detail.

The question we have been most frequently asked is, what is the best battery for general use? This is one of the most difficult to answer; however, we will first describe an office battery and its accessories, that will answer most purposes; and afterwards the most useful forms of portable machines.

It is more than desirable that the source of electromotive force should be "constant," and of all constant cells for stationary batteries, Daniell's, or one of its many modifications, is best. We prefer Watson's form, as being the most convenient and most easily attended to; its internal resistance is low, a matter of some moment in electrolytic operations, though not of so much importance in the use of the current for purely therapeutical purposes; evaporation is reduced to a minimum, and lastly, it is cheaper than most of the other modifications of the Daniell cell. It is a gravity cell on the principle of Hill's, Callaud's, Lockwood's, etc., but instead of a copper plate an inverted funnel of lead is used. The expanded portion of the funnel is perforated with a number of holes, and

rests with its mouth downwards, upon the bottom of the cell; the narrow part of the funnel coming through the liquid, and rising above the cell. This funnel, besides being the negative plate of the battery, is used to contain the crystals of sulphate of copper. A thick ring of zinc suspended in the upper part of the fluid is the positive plate. The whole is surmounted with a porcelain cover, to prevent the entrance of dust, and to check evaporation. Fifty of these cells, each of which is charged as an ordinary Daniell's cell, will furnish sufficient intensity for almost all therapeutical purposes. The battery is best placed in a cellar, arranged so that the wires can come through the floor to connect with the regulator table in the office. Some specialists prefer to have the cells connected with a switch, so that one cell can be introduced at a time into the circuit; but this is not necessary, if the operator has a *good* rheostat attached to the regulator, and a pair of rheostat handles, described in this journal under the head of new instruments. Indeed, in our judgment, it is far easier and more convenient to regulate the strength of the current by the introduction or removal of resistances, than by increasing or diminishing the number of cells. It moreover causes the battery to wear more evenly, for obvious reasons; and with a suitable galvanometer, greater precision in experiments of a delicate nature can be attained. The rheostat is the first accessory of the regulator to be considered. For absolute accuracy, the instrument made of German silver coils, graduated from one to several thousand ohms, and regulated with plugs, by which any number of units can at pleasure be introduced into the circuit, is essentially the best, but as this is a very expensive luxury, and one which few can afford, we offered as a substitute a short time ago, a plumbago rheostat* which, when supplemented by the rheostatic electrodes just alluded to, fulfils all practical purposes. With these instruments, the current can be increased or diminished with the greatest facility.

The next accessory in order of importance is the galvan-

* October number Journal of Electrology and Neurology, page 150.

ometer. One of Bradley's tangent instruments, Sprague's universal, or Gaiffe's new medical galvanometer, are among the most useful. In this instrument exactness is essential, and the ordinary galvanoscopes (which give no measurement of the current whatever) are not to be recommended. Dr. Felton of Potsdam, N. Y., who is well known as a distinguished worker in electro-therapy, promises the profession a suitable and reliable galvanometer which will not be too costly. We look forward to its appearance with pleasure.

If the regulator contain an induction-coil, the galvanometer should not be a fixture; as the motion of the needle, and consequently the accuracy of the instrument, is liable to be affected by it. An automatic rheotome, regulated for quick and slow interruptions, is a useful attachment to a battery, but by no means an essential, as the interruptions can always be made with the finger interrupter on an ordinary rheotomic electrode handle, or the same can be effected by means of the pedal rheotome of Duchenne; although these cheaper substitutes are not quite so convenient to use, nor can the same accuracy of intermission and contact be attained with them as with the automatic instrument, which may be worked either with a clock movement, or with a cell and magnet at the option of the purchaser.

The commutator or current reverser is another useful part of the regulator; it may be automatic and worked with the same motor as the rheotome. For the continuous current, where occasional changes in the direction of the current are required, the ordinary hand pole-changer is absolutely necessary, so that a really complete cabinet battery should be provided with both forms of commutator. The best material for the regulator table, is decidedly marble or polished slate. It is practically a non conductor, does not absorb moisture, and is not liable to warp or crack.

Cabinet batteries, as usually made, have in addition an induction coil; this, in our judgment, is a mistake; it is much better to have this useful instrument on a separate stand at a distance from the instrument under consideration. There is

then no possibility of the accuracy of the galvanometer being interfered with by it.

For a portable instrument in which absolute constancy is required we know of no better cell than the chloride of silver battery. Twenty to thirty of these cells yield sufficient force for every-day requirements, as far as purely therapeutic purposes are concerned, but do not furnish quantity enough for electrolytic operations of any magnitude. They form a very clean battery and require but little attention.

For electrolysis of large growths a portable absolutely constant battery is an impossibility. We are in the habit of using a carbon zinc battery in electropoion fluid, of the pattern known as the Bartlett battery. This, although not constant by any means, can be made practically so during even the most prolonged operation by having the battery freshly charged, and keeping the needle of the galvanometer at the required point by means of the proper use of the rheostat. As we have already elsewhere* described the various forms of electrodes, it is unnecessary to here enter in a re-description of them. In our next number we hope to describe the most useful induction machines and their accessory instruments.

New Books and Instruments.

BRAIN WORK AND OVERWORK. By DR. H. C. WOOD, Clinical Professor of Nervous Diseases in the University of Pennsylvania, Member of the National Academy of Sciences. Philadelphia. Presley Blakiston. 1880. pp. 126. Cloth. Price, 50 cents.

Although written more for popular than professional reading, this little work is well worth the perusal of every physician. It is full of practical hints and suggestions. The author is not one of those alarmists, who preach the great increase of nervous disease owing to the progress of civilization. He shows conclusively that the statistics of nervous diseases as at present taken, are not to be accepted

* Textbook of Electro-therapeutics, page 171.

as infallible. Many diseases of a purely neurotic origin, lead to a pathological lesion of some organ from which death ensues; a certificate of death caused by the pathological lesion is made out and goes on record, without any mention being made of the lifelong neurosis, as the primary cause, and on the other hand, deaths are recorded as being due to disease of the nervous system which are directly traceable to other causes. He says, "A man dies of convulsions due to excrementitious poison retained in the system, because the kidneys are diseased and unable to separate from the blood the noxious matters which are continually being formed in the body. Another man dies of apoplexy, because the diseased kidneys have produced simultaneously both a disease of the arteries, whereby their coats have lost their toughness and become brittle, and also an increase in the size and power of the heart, which causes it to drive the blood with excessive force. . . . The current breaks through into the brain tissue . . . and death from apoplexy results. . . . A very large number of the most fatal of nervous diseases occur especially in early childhood. These are in many instances the direct product of privations, or of gross violations of the laws of health. As the science of hygiene is being more widely studied, and more effort put forth to obey some of the most obvious hygienic laws, the nervous diseases of early childhood are becoming less frequent.

. . . "The history of epilepsy is but too often that of a slow but irresistibly progressive failure of mental power, until it may be the boy or girl disappears in the gloom of the idiot asylum, to die of a pneumonia or of a fever. Insanity rages or mopes in the wards of a hospital in after years to be noted by the registrar as a fatal dysentery," and so on, he gives examples of the utter unreliabity of the statistics of nervous disease based on the death register, as at present carried out. In speaking of excess in the use of alcohol, tobacco, coffee, and tea, as causes of nervous affections he places the subject fairly and squarely before the reader in a manner that is quite refreshing to one who has been just buried in the depths of *intemperate* effusion from the pen of an intolerant total abstainer. His words are, "It is by no means clear that any evil results are produced by the habitual employment of small quantities of well-diluted alcohol, as beer or wine. Only a few general truths can be affirmed with certainty. It may be assumed as demonstrated, that in the young and vigorous man, not overworked, and supplied with plenty of good food, alcohol is not in any sense a necessity; and if in the least excess, does harm. It tends to provoke appetite and promote digestion, when too much is already eaten and digested. It tends to limit tissue waste, whereas in health, tissue changes rarely, if ever, proceed too fast. It is plain that to the seden-

tary person, whose unused muscles require little food and waste too slowly, alcohol is doubly dangerous. The use of wine is more apt to be injurious to the clerk than to the peasant, to the dweller in the city than to the roamer on the mountain. The old English squire was able to get drunk every night through a long life because every morning he galloped madly twenty or thirty miles across the country after the hounds. The violent exercise renewed his tissues, used up the surplus food, flushed the glands, which are the sewers of the system, and washed out through sweating skin, the excess of alcohol and the impurities produced by it, and thereby prevented his sensualities from having a worse effect than an occasional attack of the gout. To those whom hard fate deprives of a supply of proper food, I believe alcohol, in the form of beer, or a light 'Land Wein,' is a great boon. It renders the bit of bread and cheese almost a sumptuous meal; it aids the digestion of coarse food, which might otherwise be a load to the stomach, and, like tobacco, takes off some of the edge of physical hardship. In Europe the food of the masses is very restricted in variety, and often scanty and unwholesome. Without wine or beer, life would, seemingly, be harder than at present. In America, every one who works has an abundance of good food, and alcoholic beverages are unnecessary to the young and vigorous. On the other hand, as the years draw on apace, and the forces of life fail, wine becomes a valuable aid and comfort. The weariness of age, with its manifold annoyances, craves a slight stimulant narcotic; the feeble digestion needs strengthening; the general failure of force is well met by a substance whose destruction in the system shall yield without effort much of power. In the mentally overworked, wine in moderation is perhaps beneficial. In all cases it must be borne in mind that there is great danger, not only from excess of a weak alcoholic drug, but also from undiluted strong spirits, even when taken in small quantities." Of tobacco he says, "There is much reason for believing that tobacco lessens the waste of nervous tissue, enabling it to perform its labor with less friction, so to speak, than would otherwise be the case. . . . Moderation in the use of tobacco is almost as necessary to the brain-worker as is moderation in the use of alcohol. I am quite sure that very frequently nervous breakdown is hurried and assisted in its development by the constant employment of the drug. . . . I have seen a large number of cases in which tobacco had evidently been very potent for evil; and my experience seems to warrant me in stating that very frequently, if not usually, in the nervous American, who works hard with his brain and takes but litle exercise, more than two mild cigars a day is injurious; and that it is best to take the smoke after dinner, during the hours of rest."

The author enters quite fully into the nervous affections caused by the use of tea and coffee, and individualizes the classes of persons who are injured or benefited by their use.

He also explains the necessity of suitable rest and recreation, and insists that the mental exertion required for sports or games should be a minimum, and of a different kind from that required in performing the daily work. He explains that it is not work that wears out so much as worry, care, and anxiety, and lays down the following rules for the observance of brain-workers:

1. To avoid excitement and emotional disturbance as far as possible.
2. To take proper rest, one proportionate to the labor.
3. To keep in order the instruments with which the brain works.
4. To avoid unnecessary labor and worry.
5. To avoid overtaxing the unmatured brain.

The style of the work is terse and forcible, there is no wasting of words. At the same time the language used is flowing and easy, and well calculated to entertain the average reader.

Another Improvement on the Rheostat.

Since our last number was published, we have made quite an improvement on the rheostat described in our October issue. In the improved instrument the rheostat is attached to one of the electrode handles in such a position as to bring the switch immediately under the control of the index finger of the operator (as in the interrupting handle), so that the flow of the current can be regulated without having to interrupt the application for the purpose of liberating one of the occupied hands to increase or diminish the number of cells.

The instrument is equally applicable to the galvanic battery and the induction machine. From this it will readily be seen that the strength of the current can, by the use of this instrument, be increased or diminished at pleasure during the treatment of a patient, without once being obliged to touch the battery, which, it is needless to say, is a great advantage. Where very high resistances are needed, two of those rheostats (one from each pole) may be used.

The instrument can be obtained from any of the electrical instrument makers whose advertisements appear in this journal.

BOOKS AND PAMPHLETS RECEIVED.

The Physician and Surgeon.
Scientific American.
Medical Counsellor.
Archives of Medicine.

Hahnemannian Monthly.
Druggists' Circular.
North American Journal of Homœopathy.
Medical Tribune.
Chicago Medical Times.
The Physician and Bulletin of the Medico-Legal Society.
El Medico y Cirujano Centro Americano.
The Pacific Medical and Surgical Journal.
The Clinique.
Hospital Gazette.
St. Louis Clinical Review.
The Homœopathic News.
Southern Medical Record.
The St. Louis Clinical Record.
The Michigan Medical News.
Revue Homœopathique.
The Buffalo Medical and Surgical Journal.
The Southern Clinic.
The Obstetric Gazette.
The Homœopathic Times.
The New York Eclectic Medical and Surgical Journal.
The Eclectic Medical Journal.
The Homœopathic Journal of Obstetrics.
The Ohio Medical Recorder.
The Organon.
The Maryland Medical Journal.
Rivista Sperimentale di Medicina Legale.

Sparks and Flashes.

SEVERAL of the "*high deluded*" practitioners say they have lost confidence in fluxions, since they read Dr. Deschere's expose of the process in the *North American Journal* for February last.

THE Galvano-Faradic Company of this city, promise the profession a superior pocket induction machine, of which we hope to be in a position to give a full description in our next number.

WE have seen cases of cerebral and spinal anæmia much benefited by the use of Tokay wine. Half a wineglassful three times a day, of Reich's importation, will be found a valuable prescription in many cases.

DR. WHITTAKER, in the Cincinnati *Lancet and Clinic*, reports good results from the use of hypodermic injections of Ether in sciatica.

DR. JOHN C. MINOR, at a recent meeting of the New York Medico-Chirurgical Society, reported a case of traumatic tetanus cured by the galvanic current, after trial of Calabar bean, Chloral, etc.

WE understand that Dr. Wm. A. Hammond and Appleton & Co. have brought a suit against Dr. A. McLane Hamilton and H. C. Lea for infringement of the copyright of Dr. Hammond's work on *Diseases of the Nervous System.*

Odds and Ends.

SUGGESTIONS TO STUDENTS.

BY H. N GODDEN, WARSAW, ILL.

I WILL give a few observations in regard to the effects of galvanism and faradism, as I have repeatedly verified them during a somewhat extended course of experiment, with a 50 and 60 cell gravity battery and a Kidder electro-magnetic battery. The gustatory nerve is excited by the galvanic current to the extent of producing a "coppery" taste, as it is called by most writers, though the sensation is peculiar to electricity, and is shared, so far as I know, by nothing else. Why no other taste is ever produced I can give no explanation except that given for all other substances, *i. e.*, that each gives rise to a stimulation of the gustatory nerve peculiar to itself.

In order to produce this taste it is not necessary to place one electrode on the tongue, but is frequently excited by a current in distant parts, as through the neck, or through the head in parts remote from the gustatory nerve, and I have observed it on one or two occasions when passing a strong current, with one pole on the nucha, the other at a distant point. The optic nerve is stimulated, so that flashes of light are seen. This, as the above, does not require the current to directly traverse the optic nerve, but often appears when the current is passed through any part of the head. It is probable that in those cases where the symptoms of taste and light appear, when the current does not traverse the trunk of the gustatory or optic nerve, these sensations are the result of irritation of the deep fibres of the nerves in question.

I have never succeeded in producing any sense of smell, though it is by no means difficult to so excite the nasal mucous membrane as to cause an increased flow of mucus. I have, several times, relieved acute catarrh by passing an electrode down the side of the nose for a few minutes.

Long-continued and frequent use of a strong current (40 to 60 cells), passing it from hand to hand, brings about a sensitive condition, such that the use of even a less current will bring, or a feeling similar to that attending sick or bilious headache. I have actually produced a mild attack of that kind on myself by the use of a current of 50 cells. In nervous or neuralgic headaches I have frequently used both the galvanic and faradic currents with excellent results.

There seems to be such a thing as unduly stimulating a person with electricity, for it is not unusual that the peristaltic action of the bowels and menstruation are both excited by galvanic currents, passed through distant parts of the body; also sight and taste may be excited by passing a current from hand to hand through the body. The peristaltic action of the bowels can be very easily excited by passing a tolerably strong current from the nucha to the hypogastrium.

Much of this last, as well as the vomiting sometimes produced by a too heavy dose in the central galvanization of Beard & Rockwell, is possibly due to irritation of the pneumogastric. Most of my experiments have been on myself, and have been carefully watched.

One thing more in regard to overdosing. I have several times touched both electrodes with the tip of my tongue, when 15 or 20 cells were in connection, and not only was the tongue jerked, but there was a flash of light perceived; yet, if there was no electricity, except what passed from one electrode to the other through the tip of my tongue, whence the irritation of the retina? There was no sense of taste. This and other similar symptoms are produced much more readily when the body has been some time under the influence of the galvanic current.

The faradic current seems to have but little effect, except as a stimulant, when applied generally. The galvanic current, on the contrary, is a powerful agent for improving nutrition.

My experience has been that in cases where either current could be used, benefit was much more permanent from the use of the galvanic current, though effects were more rapid from the faradic, but also more evanescent.

I refer to the more general applications of both forms. Each has its own peculiar place in local and in many general applications.

In using the galvanic current the temptation is very great to get marked effects from one sitting, and if this cannot be done with a mild current, to use a stronger one; but although this is allowable at times, as a rule the operator and patient must have patience and wait for the slower effects of a mild current. This is especially necessary; for the changes begun by the current do not stop when the sitting ends, but continue sometimes for weeks. Hence, although a strong current could be borne, one of 4 or 6 cells will very often make

a better cure than 20, and even make one when a strong current would fail.

The exact dose can only be approximated, except in stabile applications. Many cases require labile applications, and here the best *I* can do is to keep the dose between certain limits. A rheostat helps some. Dr. Butler's is probably the best on the whole. I have been and still am experimenting on different resistants, and have so far failed to get a perfectly satisfactory instrument.

It seems to me that if an electro-magnetic machine could be made that would give more rapid vibrations than any now made, it would give much better results than are now attained. I would have a vibrator which will give 60 or more strokes per second.

Miscellaneous Items.

DEATH FROM AN ELECTRIC SHOCK.—An accident of an extraordinary nature occurred on Tuesday night, January 17th, at the Holte theatre, Ashton, a suburb of Birmingham. The stage is lighted by two electric lights, and when the candles are not burning the connections used for the purpose of crossing the current are hung up over the orchestra. After the performance of the pantomime, Mr. Bruno, the euphonium player, was leaving with the other members of the band, when, presumably out of curiosity, he caught hold of the two brass connections referred to; the man in charge called out to him with the object of warning him of the danger he was incurring. The warning, however, came too late. Mr. Bruno received the full shock of the electric current, generated by a powerful battery which supplies the whole of the lamps in the building and grounds. It is said that, the candles not then being burning, Mr. Bruno was unable to disengage himself, and pulled the wire down. The shock rendered him insensible. A medical man was at once sent for, and restoratives applied, but Mr. Bruno died in about forty minutes afterwards.—*The Electrician.*

ON THE PATHOLOGICAL ANATOMY OF HYDROPHOBIA. WELLER (*Archiv. f. Psych.* ix, p. 493).—The following conclusions are founded upon an examination of the nervous systems of seven dogs and one man, death in all cases having resulted from hydrophobia: (1.) Hydrophobia shows itself in the nerve-centres, as an inflammatory process, originating in the vessels. It is characterized by perivascular exudation and infiltration of the tissues with lymphoid elements; the leucocytes are aggregated, more or less closely, in clusters or foci. At the same time, and probably as a product of degenerative

changes in the nerve elements, peculiar fatty bodies appear in the perivascular spaces. These fatty bodies are pathognomonic of hydrophobia ; in no other disease have objects, resembling them in size, form, and number, hitherto been observed. They are identical with the "highly refractile hyaloid substance" of earlier authors, and are best seen in fresh preparations. (2.) The inflammatory process is an early stage of acute myelitis or encephalitis. That it does not, like acute myelitis generally, go on to softening, depends on the short duration of the disease, this again being probably due to the localization of the lesion. (3.) The pathological changes were most marked in the medulla oblongata, especially in the nuclei of the eighth nerve. In the spinal cord the parts most affected were the surroundings of the central canal, the anterior cornua, and the margins of the posterior cornua. (4.) In the human brain the process was confined to the spinal cord and medulla ; in the dogs' brains it was seen also in the corpora quadrigemina, the basal ganglia, and the cerebral hemispheres ; it was frequently found in the olfactory convolutions, but very rarely in any other part of the hemispheres, and in the cerebellum it was never found.—*Brain.*

THE CAUSATION OF SLEEP.—Dr. Siemens, says the *Medical and Surgical Reporter*, concludes that sleep is due to the activity of certain circumscribed parts of the brain, which form an inhibitory centre, and which are situated in the medulla oblongata, near to the convulsive centre. In support of this view, the connection between sleep and epilepsy is alleged. The inhibitory sleep centres stand in direct antagonism to the cerebral cortex ; if the one is in a state of activity the other remains passive ; the former can only exercise its function when the cortical substance is either inactive or nearly so. Sleep is much more easily induced in childhood, as the convolutions of the brain are at that time only partially developed. Sleep is also much more frequent and continuous when the cortical substance has degenerated, as in paralytic dementia ; when its nutrition is faulty, as in anæmic conditions ; also when it is to some extent paralyzed by the action of hypnotics or by excessive cold. On the other hand, no sleep can be obtained when the cortex is in a state of activity, due to strong psychic impressions, excesses, alcoholism, or any form of mental disease. When, owing to some morbid condition, sleep has been absent for any length of time, the products of fatigue must have generated in the body in large quantities, but still the hyperactivity prevents the occurrence of sleep.—*The Druggists' Circular and Chemical Gazette.*

EFFECTS OF LOCAL IRRITATION ON PAIN.—At the meeting of the Académie de Medecine on the 4th of November (*Bulletin*), Dr. Dumontpallier read a memoir on "Local Therapeutical Analgesia"

induced by the irritation of the similar region on the opposite side of the body. From this communication it results that pain seated at one point of the body yields to an injection of simple water (which, as is known, produces local irritation) at a similar point on the opposite side. In neuralgias of different seat and nature, in acute articular rheumatism, and in rheumatic or toxical neuralgia, I have requested patients to mark with the finger the painful points, and that being done I have sought out similar points on the opposite side of the body, and at these latter points, for the most part not painful, I have practiced injections of water or simple punctures. As soon as irritation has been produced on the sound side, the patients have acknowledged a diminution, and often a complete cessation, of the pain on the bad side, and that, I repeat, in cases of acute rheumatic arthritis. I have chosen this last example as a demonstration, as one could scarcely, in such a case, be deceived by patients. The joint may be red, swollen, hot, and painful to the touch or the slightest movement, but immediately the little operation is terminated, the patients find that the pain diminishes or disappears, and that they can perform flexion or extension of the joint; the swelling preventing much motion, but the pain is gone. The following are the conclusions arrived at by Dumontpallier: 1. Every subcutaneous medicinal injection is a complex operation, in which a part must be assigned to the medicinal substance, and a part to the irritation produced. 2. The local irritation is transmitted from the periphery to the sensitive centres, and there determines a modification, the consequence of which is a diminution or cessation of the peripheric pain. 3. The real, anatomical seat of certain peripheric pains should then be in the sensitive centres; an assertion which seems demonstrated by the crossed action of induced peripheric irritation. 4. Irritation induced loco dolenti, or in the vicinity of the painful point, assuages or causes the cessation of pain; and when the irritation is induced at symmetrical points on the opposite side of the body, it proves often sufficient to cause a complete and durable cessation of pain.—*Medical Times and Gazette.*

NIAUDET'S NEW CHLORIDE OF LIME PILE—A pile, or rather a pile element, or voltaic couple, is, as well known, always composed of two solid electrodes, which are immersed in one or two liquids. One of these two electrodes is always of zinc, this metal being by far the most advantageous of all those which are practically admissible. If we try to substitute iron for it, on account of its lower price, or aluminum, on account of its powerful chemical affinities, we obtain very unsatisfactory results, the electromotive force being notably less. This advantage, which is possessed by zinc, was known to Volta, who employed it in his first pile. It is very possible, how-

ever, that in course of time we may succeed in substituting some more advantageous substance for it; but if we do it will prove an important discovery and brilliant invention.

The other electrode is formed of a metal less readily attacked than zinc, such as copper, silver, and platinum. Yet, instead of a metal, we may use carbon, which is also a conducting material, although to a less degree than metals. These two electrodes, then, are immersed in liquids, and the rôle of these we will now explain. The first of these liquids, the only one indispensable, acts on the zinc, dissolves it, and generally oxidizes it. This chemical action is correlated with the production of the electric current, and it is the essential condition of its circulation. As we have before said, the zinc is generally oxidized; a decomposition of water takes place, oxide of zinc is formed, and hydrogen set free. Now the hydrogen is disengaged on the second electrode, and the importance of this fact we will shortly explain. The first liquid is often dilute sulphuric acid, although any saline solution whatever may be employed. One of the best that we can use is that of chloride of sodium or common salt. In certain countries the battery generally employed is composed of zinc, salt water, and carbon. Some experiments of M. Poggendorff show that a solution of chloride of sodium in certain cases gives an electromotive force superior to that obtained from sulphuric acid diluted with four times its weight of water. It goes without saying that it is expedient to make use of the most conductive solutions; and, regarded from this standpoint, salt water is one of the best liquids that can be employed. It exhibits, moreover, one important peculiarity in that it possesses a maximum of conductivity which corresponds, not with saturation, but to a proportion of 24 parts of salt to 100 of water. We have now to explain the rôle of a second liquid, which, although not indispensable, is yet very useful, as we shall see. We have already said that the hydrogen produced by chemical action was set free from the second electrode. From this there results an increase of resistance and a diminution of electromotive force, which concur in producing a reduction of intensity. This important phenomenon has been attributed to the *polarization of the conductive electrode*, and it has been the object of numerous studies by many physicists to overcome it. To effect this several methods have been employed, the principal one being the use of liquids which would absorb the hydrogen. Of such liquids, solutions of nitrate and sulphate of copper (as in Daniell's battery) are most efficacious; nitric acid (as used in the Grove and Bunsen batteries) is less satisfactory. All other materials that have been used give poor results, for they depolarize the electrode only incompletely; and while, in some cases, they offer some opposition to the reduction

of intensity, they do not absolutely overcome it. These general principles being kept in view, we shall be prepared to describe M. Niaudet's pile. In this new battery the electrodes are of zinc and carbon, and the liquids are solutions of chloride of sodium and chloride of lime. The last named material, then, is here the depolarizing liquid whose mission it is to absorb the hydrogen. Chloride of lime is a substance which is produced in large quantities in the industries, and is used both in bleaching and as a disinfectant. It is a mixture of lime, hypochlorite of lime, and chloride of calcium. The hypochlorite of lime is alone active, the hypochlorous acid that it contains being composed of oxygen and chlorine, which both combine with hydrogen to form water and hydrochloric acid. The latter acid attacks the lime and produces chloride of calcium. The use of these materials has the important advantage that all the substances which form are soluble, and thus the liquid remains limpid. As may be seen also, even the lime becomes in time transformed into chloride of calcium, one of the most soluble substances known.

Another capital property of these solutions is that they have no action on the zinc so long as the circuit is open; and consequently, during the interval that the pile is not in operation, it is attended by no expense. In an economical point of view this feature is of great importance, and is the opposite of what we find in the Daniell battery, which is otherwise so near perfect. The electromotive force of the chloride of lime pile is considerable, and equals 1.6 volts; or, in other words, superior to one and a half Daniell's. The truth is, the pile is not absolutely depolarized; for when, in a slightly resistent current, it is closed, it becomes weak. But it regains its first strength very perceptibly after quite a short period of rest. In the majority of applications, however, it behaves as if it were completely depolarized. Chloride of lime, as well known, has a disagreeable odor; so it has been found necessary to close the vessel containing the pile by a stopper covered with wax. The glass receptacle contains the carbon immersed in the solution of chloride of lime held in a porous cup; and around the latter is rolled the zinc, which in its turn is immersed in the salt water. The zinc and its strip are all in one piece, being cut out of the same sheet of metal, while ordinarily a strip of copper is soldered to the zinc, thus forming a local couple which is prejudicial. The zinc is kept at an even and very short distance from the porous cup by interposing small plugs of wood, and these are held between the central cup and the zinc by means of cords tied around the latter. Owing to the latter fact the zinc does not reach the bottom of the liquid, where, as shown by general experience, there form local couples which result in active waste, and a consequent pure loss.—*Scientific American's Supplement.*

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